The Refrigeration Service Engineer

Vol. 5
No. 3

MARCH • 1937

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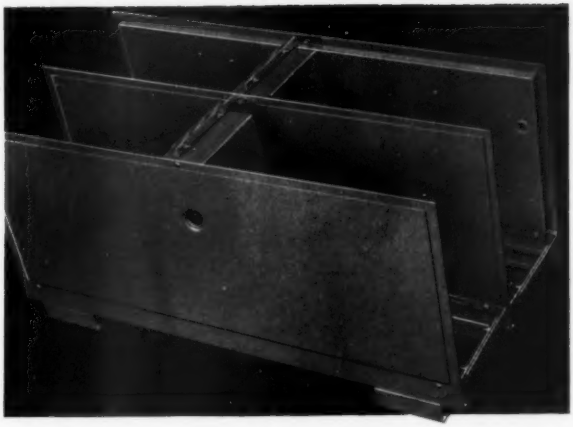

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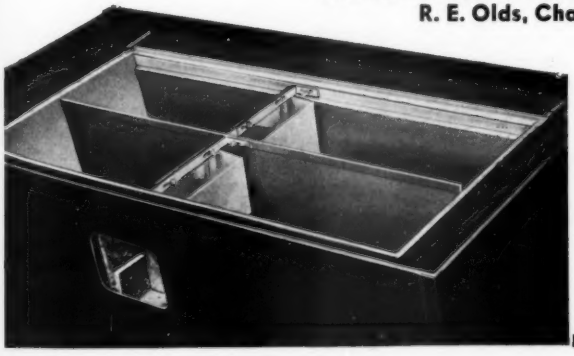

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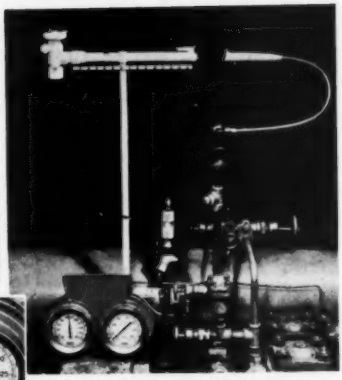

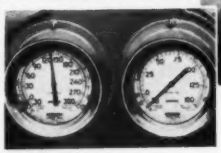

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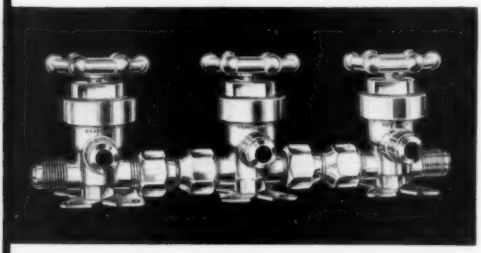

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The Refrigeration Service Engineer

Vol. 5 No. 3

March 1937

A Monthly Illustrated Journal Devoted to the Interests of the Refrigeration Service Engineer in the Servicing of Domestic and Small Commercial Refrigeration Systems and Oil Burners

Official Organ
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COVER

Mr. E. Gygax, President St. Louis chapter, R.S.E.S. and Chief Engineer Curtis Refrigerating Machine Co., St. Louis, describes a unique refrigeration installation illustrated on this month's cover.

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The Refrigeration Service Engineer

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Air Conditioning

ARTICLE ONE

by W. C. FARMINGDALE

• Everyone in the air conditioning business is looking forward to a very prosperous year. It is estimated that thousands of jobs will be sold before the end of August. Obviously this means that many men will be employed in installing these units and many more men will be employed in years to come in keeping these jobs in operating order.

The present day refrigeration installation and service men are perhaps the best fitted of any group of mechanics to handle this work. However, air conditioning involves many factors not encountered in ordinary refrigeration work.

This series of articles is written for the express purpose of explaining these factors so that the refrigeration engineer can better understand the purpose of each piece of equipment used by various manufacturers, and so that the service man can intelligently diagnose troubles in air conditioning units. Often times a complaint will be registered that the air-conditioner is working improperly when there is nothing wrong with the equipment. Therefore the service man must be so well versed in the theory of air conditioning that he can explain to the customer just why the machine seems to be working improperly. For instance, he must be able to tell the customer that in spite of the fact that the thermometer on the wall of the conditioned room reads 80 degrees and the outside thermometer also reads 80 degrees, the air conditioning unit is still working properly, and is doing a good job of conditioning.

AIR CONDITIONING— AN INTANGIBLE BUSINESS

AT the very start, men who intend to work in air conditioning must realize that they are working with an intangible product. No one can see or touch air conditioning. It even takes time to feel the effects of air conditioning.

A room which is properly air conditioned should not "shock" a person who enters from another room. That is to say, when walking into an air conditioned room from a connecting room, there should be no sudden realization that the room is conditioned. The effects of a well conditioned room won't be felt for perhaps fifteen minutes and then a person will start to wonder why he feels livelier and just where does that *buoyant* effect come from. *A properly conditioned room certainly gives a person a "lift" which is actually felt!*

The other day, the writer had occasion to contact the assistant cashier of a large bank in Manhattan while checking the final adjustments on an installation which had been in use for three weeks. The installation had been made in a room about 20 feet by 30 feet by 6½ feet. In this small space, eleven persons worked. Because of the low ceiling, the room had always been a ventilation problem.

In the course of conversation, the vice-president said, "Do you know that for the first two weeks this installation was work-

ing, I was convinced that we'd been sold a pig in a poke? Today, however, I'd say we made a good investment.

"From the salesman's description of air conditioning, we thought that as soon as we opened the door into this room we would feel a tremendous up-lifting because of the crisp, clean, fresh air. Such was not the case and we felt that we had been 'stuck.'

"For the past two weeks, however, I've noticed that formerly about two o'clock in the afternoon everyone seemed to lag and appear to be tired but now there doesn't seem to be any let down. I've checked up on my own feelings and have found that whereas I used to feel mighty tired at the end of the day, now I don't seem to feel that way."

A general check-up among the eleven employees bore out his conclusions as to the effect of air conditioning.

This installation is one that is doing the work it is intended to do; that is, to create greater efficiency among workers, not by speed-up methods or by promises of bonuses, but by merely providing better working conditions for the employees.

The point to be brought out in this example is that air conditioning deals with the intangible. It took this customer two weeks to realize that the equipment was really working. This customer is getting more and better work out of his employees through the use of an intangible device—air conditioning!

Air conditioning is going to be a great factor in "America's Higher Standard of Living."

Air Conditioning Is an All Year Job

Refrigeration engineers are inclined to think of air conditioning as merely a seasonal cooling business. This conception is entirely wrong. Air conditioning is a year 'round business. This fact is borne out by the sales records of national air conditioning companies. One company sold more complete units in the month of December than it did in any other month.

Summer cooling is just one of the six phases of air conditioning. It is perhaps the one phase where its effects can be noticed immediately and it is therefore better known to the public than are the other phases. Summer cooling, however, requires use only about twenty days of the year. Other phases, however, are used 365 days of the year.

The Six Phases of Air Conditioning

1. Ventilation
2. Circulation
3. Filteration

} used all year round

4. Heating
5. Humidifying

} used in winter

6. Cooling (dehumidifying)—used in summer.

Before describing in detail each phase of air conditioning it might be well to point out at this time that there are several distinct types of conditioners used by various manufacturers.

Type One—Duct Systems

Duct systems are generally used on large installations such as theatres, restaurants, conference rooms, etc. The ducts are generally located between the walls of the building and only small grilles show in the conditioned rooms. The equipment for providing one or all phases of air conditioning is located remote from the conditioned room. Large fans are located in the ducts to provide circulation. Filters in the ducts clean the air before it is passed into the room. If the installation also provides heating and cooling, a heating coil and a cooling coil are so arranged in the duct that all the conditioned air must pass over these coils before entering the conditioned room.

Type Two—Portable Conditioner

The portable conditioner, so called because no permanent connections are made to the conditioning unit, generally supplies all phases of air conditioning, except the heating phase. It is generally built in a compact, finished cabinet that sits in the window of a room and appears to be a piece of furniture. It generally has a built-in refrigerating machine which is enclosed in a sound-proof container. The compressor is generally water-cooled and has two pieces of flexible hose which are connected to the water supply and to the drain. Sometimes, however, the compressor is air-cooled. In this case, air is brought into the condensing unit through a duct which extends out of the window.

Type Three—Built-in Room Cooler

The built-in room conditioner is similar in outward appearance to the portable conditioner. It, however, is capable of supplying all six phases of air conditioning. All

connections are made permanently. All water and heating connections are made with pipe. Electrical connections are made with either B.X. or solid conduit.

Some manufacturers provide a unit with a built-in refrigerating machine. Others supply a unit which must have a remotely located refrigerating machine.

Note: Since most air conditioning refrigerating units use a water-cooled condenser, consuming up to *1000 gallons of water per hour*, the time is fast approaching when city ordinances will require the use of evaporative condensers on all refrigeration equipment to save water. In this case, the condenser may be located remote from the refrigerating machine and thus the refrigeration machine cannot be properly called a condensing unit. Hence, there is a movement afoot among the leaders in the air conditioning field to call what is commonly known as the condensing unit (motor, compressor, condenser and receiver) a refrigerating machine. Therefore, in this series, the term refrigerating machine will be used in place of the commoner term, condensing unit.

Ventilating and Circulating Phases

The early models of individual room conditioners just provide a means of either heating or cooling a room. The heated or cooled air was continuously circulated by means of fans located in the unit.

If many people were in the room and especially if many people were smoking, although the atmosphere was comfortable as far as temperature was concerned, the atmosphere was far from being well conditioned. No means was provided for the changing of the air in the room. The air soon became foul smelling and the occupants of the room became drowsy.

Practically every present-day air conditioner supplies some means for changing the air within a room. Many engineers design their equipment so that there is at least one complete air change per hour for every person within the room. In this way the air is always kept fresh and alive. The occupants of the room retain their vitality and seem never to tire.

On duct systems, the inlet side of the fans is connected to a duct which runs to a window. The return duct from the conditioned room is teed into this supply duct by means of a damper, so that by adjusting the damper the amount of fresh air can be adjusted to suit the recirculated air according to the conditions found in that particular installation.

It is apparent that the damper setting will have to vary with the outside temperatures or else the temperature of the air on the discharge side of the system would vary greatly, causing drafts in the conditioned room. To overcome this possibility, most duct installations have automatic damper mechanism. The construction and operation of several types of these mechanisms will be discussed later in the series.

Ventilation is provided on portable or built-in room conditioners by placing the unit in front of the window and running a duct from the unit, to out-of-doors through the window. Large fans draw the air into the conditioner through filters thus eliminating all traces of dust and soot. The air is then passed over the heating or cooling coil and is properly conditioned before being discharged into the room. There is usually a damper located in the fresh air duct so that the amount of fresh air drawn into the conditioner can be varied to suit individual installations. It is advisable to have an automatic damper control on these units to prevent winter freeze-ups in case the heat should be shut off in cold weather while the damper is open. More will be said about automatic dampers in a later article.

Filtering Phase

Most present room conditioners provide a means of cleaning the air before it is discharged into the room. These filters are generally constructed like a honeycomb. The passages are generally coated with a very sticky substance which catches dust and soot. This substance is of such a nature that the dust and soot absorb the substance and hence become dust and soot catchers. This process continues until the combs in the filter are completely stopped up with dust and soot.

One manufacturer of this type of filter claims a 95 per cent efficiency for his filter.

A test was made using one ounce of lamp black and one ounce of pulverized coal dust. Both were completely dried and then mixed into 50,000 cubic feet of clean air. The air was then passed through the filter and 95 per cent by weight of the dusts were caught in the filter.

One large manufacturer features a noise trap in his room conditioner. It is claimed

that no more traffic noise enters a room through the fresh air duct of the conditioners. This should be a good sales argument in large cities!

Heating Phase

Most room conditioners provide for the installation of a heating coil within the conditioner. The heating coil is usually of the copper tube fin type. It can be connected to any type of steam or hot water system to provide the heating phase of the conditioner.

A room conditioner equipped with a heating phase will often provide better heating in a room than would the original radiator installation. This is true because the circulating fans drive the heated air throughout the room and into every corner of the room. The conditioners generally have an air intake which is located near the floor. This insures that the air will not stagnate near the floor and cause a cold floor.

Combined with the ventilating phase, an entirely new conception of winter comfort is obtained in a modernly conditioned room.

Humidifying Phase

Humidification is a vital phase of air conditioning. Too few people realize this fact. Furniture worth many thousands of dollars is ruined each year because of the lack of humidity in heated rooms.

Many thousands of colds each year find their beginning in hot, dry rooms. In hot, dry rooms, moisture is rapidly absorbed from a person's body and especially from the nose which is constantly passing this dried air to the lungs. When the moisture is removed from the nasal passages, these passages are left open to the direct attack of dust and germs and colds result.

There are many types of humidifiers in use today on room conditioners. Some manufacturers use a motor driven atomizer which consists of breaking up water into a fine mist and then blowing it out into the hot air stream of the conditioners. Others use a spray type humidifier which consists of a nozzle and a flat disc. Water under pressure issues in a fine stream from the nozzle and strikes a flat disc which is held about 6 inches from the nozzle. The impact of the water on the disc breaks up the stream into a fine mist which is pulled into the air stream by the fans. Still another manufacturer uses a flat pan located in the hot air stream. The hot air in passing over the pan, picks up moisture and thus humidifies the air.

Cooling Phase

The cooling phase is generally accomplished by means of a refrigerating machine and cooling coil similar in design and construction to that of a commercial job.

However, there are several manufacturers who use a large copper finned coil through which cold water is passed. The cold water provides a means of cooling the conditioned air and thus eliminates the necessity for the relatively expensive refrigerating machine. Needless to say, this system is only feasible in those locations where water is very cheap.

The one problem met in air conditioning that is not often met in commercial refrigeration is that of condensate removal. The commercial refrigerator coil is generally installed on the first floor and a drain pipe is run from the drip pan through the floor to the basement drain. However, air conditioner cooling coils may be located on any floor and hence it is not practical to dispose of the condensate through a gravity drain. Some means must be provided for condensate removal. The methods used are as many as the number of manufacturers.

On portable jobs, some manufacturers use a venturi in the water line to the compressor. The venturi consists of two sections of pipe joined by a much smaller pipe. Because the water is speeded up tremendously in passing through the smaller pipe, a vacuum is created at the smaller pipe. The condensate drain is connected at the smaller pipe. All the time the compressor is operating, the venturi is removing condensate.

Other manufacturers have a built-in atomizer into which the condensate drains. The atomizer takes the condensate, breaks it up into a mist and discharges it out the window.

Another device consists of a centrifugal pump which is located alongside the conditioner. This pump builds up a pressure on the condensate and forces it into a drain at a wash basin or a sink which may be located four or five feet higher than the unit.

Still another condensate removal device consists of a suction pump located a distance from the conditioner. The suction pump pulls the condensate out of the drain pan as quickly as it forms.

All these devices work automatically. That is, they only work when there is condensate to be removed. They are all so wired to the circuit, that the compressor will be shut off if the condensate removal device should fail.

The April article will deal with some of the technical terms used in air conditioning.

Fourth Article

Electronics for Servicemen

This article is a study of the operation of A.C. motors

By WALTER G. CHRISTIE, B.S.E.E.

The Magnetic Circuit

BEFORE attempting to study how a.c. motors operate, it will be necessary to review the magnetic circuit.

Around every magnet there is an invisible magnetic field. This field consists of invisible lines of force (like sun rays) which go from the north pole to the south pole of the magnet. See Fig. 1.

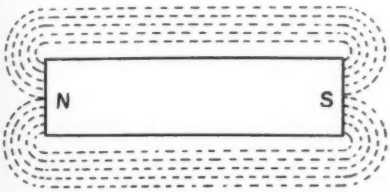


Fig. 1. Surrounding every magnet are invisible lines of force which continually flow from the north pole of the magnet to the south pole of the magnet.

Air is a poor conductor of magnetic lines of force; iron and steel, on the other hand, are good conductors of these magnetic lines. Hence, if a piece of iron is placed as in Fig. 2, the number of magnetic lines will be increased about 1000 times over the number in Fig. 1.

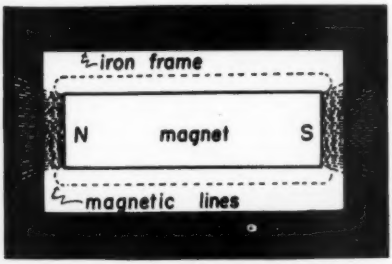


Fig. 2. Iron is an excellent conductor of magnetic lines, whereas air is a poor conductor of magnetic lines of force. If an iron frame is placed around the magnet of Fig. 1, the number of magnetic lines of force will be increased about one thousand times.

Explanation: The law of the magnetic circuit is similar to that of the electrical circuit. It may be stated as:

$$\text{M M F} = \text{Ø R}$$

$$\text{Ø} = \frac{\text{M M F}}{\text{R}}$$

$$\text{R} = \frac{\text{M M F}}{\text{Ø}}$$

in which

Ø is the number of lines of force.

M M F is the magnetic pressure of magnet.

R is the reluctance (resistance) of the path through which the lines travel.

The reluctance of air is very high (that is: air is a poor magnetic conductor) whereas iron has a very low reluctance and hence it is a very good magnetic conductor. Hence if the magnetic lines were counted in Fig. 1, there might be 1000 lines. However, if the lines were counted between the magnet and the iron shell in Fig. 2, there would be 1,000,000 lines.

From the above paragraph, it can readily be seen why motors are made out of large masses of iron.

Voltage Generation

If a conductor (piece of wire or piece of copper) is moved so that it cuts a magnetic field, a voltage will be generated between the ends of the wire. The magnitude of this voltage will depend upon

1. The speed of the wire.
2. The number of lines of force cut by the wire.
3. Number of turns of wire if the wire is in a coil.

The direction of the voltage will depend upon the path in which the wire is traveling.

For illustration, in Fig. 3, when the wire is traveling downward the voltage may act

from *A* to *B*, but when the wire is traveling upward the voltage will act from *B* to *A*. The magnitude of the voltage will depend upon how fast the wire is traveling and upon how many lines of force are cut. Let us suppose that one volt is generated by this action and that 1000 lines are cut.

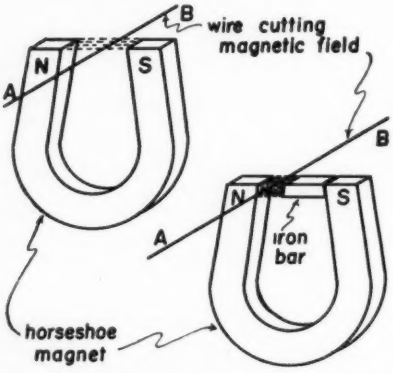


Fig. 3. Above. When wire *A-B* is moved up and down so as to cut the magnetic lines of the magnet, a voltage will be generated between points *A* and *B*.

Fig. 3A. Below. Voltage generated between *A* and *B* will be increased one hundred times over that in Fig. 3, because iron bar between poles of the magnet increased the magnet lines (sometimes called magnetic flux) one hundred times over that of Fig. 3.

Now consider Fig. 3A which contains the same magnet but a piece of iron is placed between the poles of the magnet. Let us suppose that the reluctance of the circuit has been decreased 100 times by the placing of the piece of iron in the magnetic circuit. The number of lines will now be 100,000 instead of 1000 and the voltage generated will be 100 volts instead of one volt.

Now let us suppose that instead of a single piece of wire, we had a coil with 10 turns of wire. The voltage generated would be 1000 volts instead of 100 volts.

Suppose now that the ends of the coil were connected to an outside electrical circuit as in Fig. 4. Every time the coil was moved at a fixed rate a voltage would be set up across the coil. This voltage would cause a current to flow in the circuit. If the voltage were 1000 volts, one ampere would flow through the circuit. When the coil was moved upward, the ammeter would deflect to the right; when the coil was moved downward, the ammeter would deflect to the left.

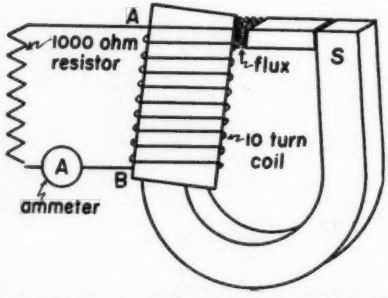


Fig. 4. Single wire of Fig. 3A has been replaced by a ten turn coil. Voltage generated will be ten times that of Fig. 3A. If one thousand volts are generated across the coil, one ampere will follow through the resistor. When the coil is moved downward, the current will flow from *A* to *B* and when moved upward will flow from *B* to *A*.

Alternating Current (a.c.)

Now suppose we move the 10 turn coil slowly through the magnetic field and study its motion. We will see that as the coil starts through the field, only the first turn of the coil will cut the field, hence only one-tenth of the total voltage will be generated

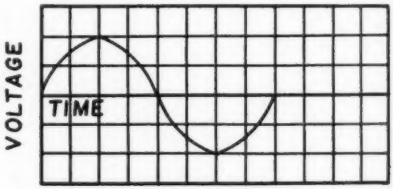


Fig. 5. Wave form single phase A.C.

until the second coil is brought into the field. Then two turns will be active and the voltage will now be 200 volts. When the third coil enters the field, 300 volts will be generated. Hence, not until all 10 coils are cutting the field simultaneously, will the 1000 volts be generated.

Suppose the coil is pushed further on to the magnet so that the first turn leaves the magnetic field. Then only 9 turns will be acting and the voltage will be 900 volts. If the coil is pushed still further, the number of turns cutting the field will be less and so the voltage will be less until all the turns are out of the field and the voltage will be zero.

Now if we start to raise the coil, the above procedure will be repeated but the direction of the voltage will change because the last turn of the coil is the first cut in

to the field. Hence, if we plot the magnitude and direction of the voltage on graph paper, we will obtain a waveform as shown in Fig. 5. This is an a.c. waveform. Notice that when no turns are cut, no voltage is generated and that when ten turns are cut, a maximum voltage is generated. Then as the turns pass out of the field the voltage gradually decreases to zero. When the coil is reversed, the voltage is reversed and as more turns cut the field, the voltage increases in this reversed direction.

Thus an alternating current is one whose intensity and direction are ever changing periodically.

A direct current is one whose direction of flow is always the same and whose intensity is fairly constant.

An A.C. Generator

An a.c. generator is called an alternator by engineers. This distinguishes it from a d.c. generator.

In an alternator there is a stator winding (*winding on the frame of the machine*) and a field winding (*winding on the revolving shaft*). This is illustrated in Fig. 6.

Notice in Fig. 6 that d.c. current is supplied to the field by means of two slip rings and two brushes. The d.c. is supplied either by batteries or by an external d.c. generator. Notice also that the wires on the stator lie between the iron pole shoe of the field magnet and the iron of the stator. Hence, there is little reluctance between the field and stator and hence there are many magnetic lines between stator and field. From Fig. 6 it can be seen that as the field revolves counter-clockwise, the turns of the coil are cut by the magnetic lines just as the coil of Fig. 4 cut the lines of the magnet in Fig. 4. Hence, if the field is turned at a constant speed by a steam engine or a turbine, the voltage generated in the stator winding will be of the same waveform as that shown in Fig. 5.

This arrangement will generate *single phase a.c. current.*

Frequency or Cycles in Alternating Current

The waveform as shown in Fig. 5 between points *A* and *B* represent one cycle. At point *B* the cycle is started over again.

When we speak of a.c. current we say 110 volt 60 cycle, 110 volt 50 cycle, 110 volt 25 cycle, etc.

By this we mean the number of cycles as shown in Fig. 5 that occur in one second. Hence, 60 cycle current means that the current fluctuates as shown in Fig. 5, 60 times each second; 25 cycle fluctuates 25 times each second.

The cycles of a generator depend upon the speed of the steam engine or prime mover which drives the alternator's field. The power companies have elaborate speed control equipment which maintains the alternator's speed constant, regardless of load. The frequency of a generating plant seldom varies one cycle from hour to hour.

Thousands of men daily use the terms, single phase, two phase and three phase currents without knowing just what polyphase currents are and how they are generated.

A phase is a single circuit. Thus the stator winding in Fig. 6 is a single phase. The current supplied by it is single phase

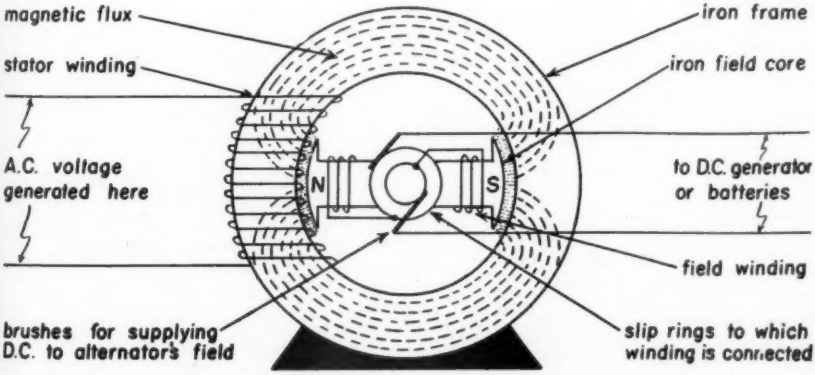


Fig. 6. Simple Diagram of a single phase alternator.

a.c. Now if the alternator has to deliver two phase current, it must have another stator winding added to it. This stator winding will be placed 90 degrees away from the other stator winding as shown in Fig. 7.

Notice that the field will be cutting phase two when it is not cutting phase one. Then it will cut phase one when it is not cutting phase two. Yet there will be a time when

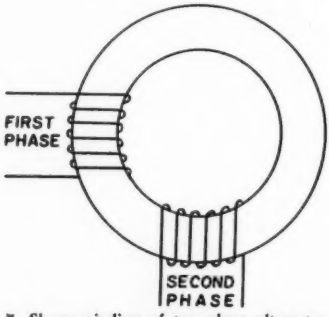


Fig. 7. Shows winding of two phase alternator stator. Note that both windings are independent of each other and they are 90 degrees apart. If each phase has the same number of turns, the voltage generated across each phase will be the same.

it will be cutting part of each phase because of the overlaps of the pole shoe. Hence, if we plot a two phase current, it will appear as in Fig. 8.

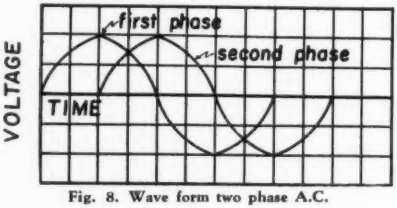


Fig. 8. Wave form two phase A.C.

A three phase alternator will have three separate windings on its stator as shown in Fig. 9.

The waveform of a three phase alternator will be as shown in Fig. 10.

Polyphase Connections

Three phase circuits are always transmitted by three hot wires and a ground leg. Hence, the main panel board will have four wires connected to it. In order to transmit the three phase power on three wires, the three windings on the alternator at the power station have to be inter-connected.

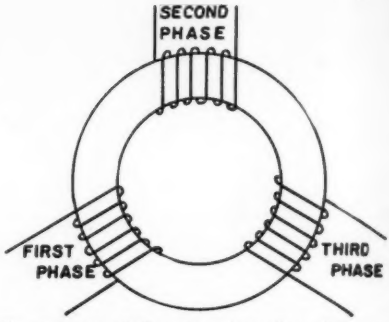


Fig. 9. Stator winding of a three phase alternator. Note each winding is independent of the others and that the windings are 120 degrees apart.

This is generally done as shown in Fig. 11.

The panel board in a customer's building will appear as in Fig. 12.

Now between *A* and *D*—*B* and *D*—*C* and *D*—there is 120 volts.

Hence, to supply current to a single phase 120 volt motor, two wires should be run

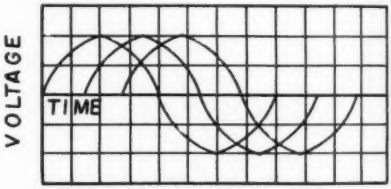


Fig. 10. Wave form three phase A.C.

from the panel board to the motor. One wire will be hooked to terminal *D;* the other will be hooked to either *A, B,* or *C.*

Now between *A* and *B*—*B* and *C*—*C* and *A*—there is 208 volts.

(The fact that there is 208 volts between these wires and not 240 volts as is generally supposed, will be explained later.)

Hence, to supply current to a 220 volt single phase motor, two wires should be run from the motor to either *A* and *B,* or *B* and *C,* or *A* and *C.* (Motors are labeled 110-220 volt. They will work on a voltage variation of plus 10 per cent. Hence, a 220 volt motor will work properly on a line supplying from 200 to 240 volts. This is figured as follows:

10 per cent of 220 = 22 volts
220 — 22 = 198 volts
220 + 22 = 242 volts

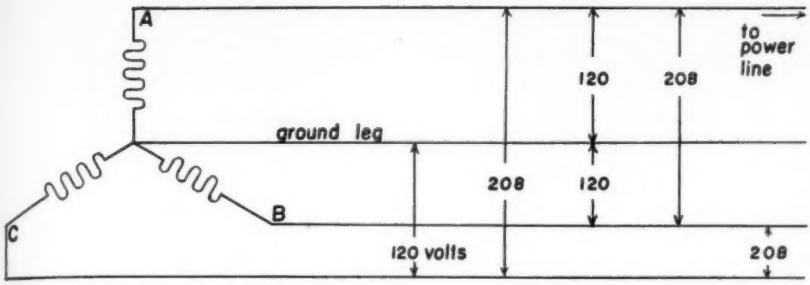


Fig. 11. Connections at alternator for supplying three phase power by means of three wires.

As will be explained later in this series, a three phase supply line never supplies a voltage higher than 208 volts per phase.)

Now to connect a three phase, 220 volt motor, three wires must be run from the motor or the motor starting box to terminals *A*, *B*, and *C*.

Trouble Shooting on Three Phase Circuits

The average three phase refrigerator or air conditioner hookup is as shown in Fig. 13.

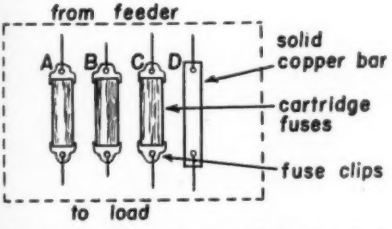


Fig. 12. Three Phase Panel. Voltages *A* to *B*—*B* to *C* and *A* to *C*, 208 volts. *A* to *D*—*B* to *D* and *C* to *D*, 120 volts.

When the compressor switch is closed, current flows from the line at *A*, through the relay coil, through the compressor switch back to the line at *B* as shown by the arrows in Fig. 13. Current flowing through the coil makes the coil a magnet and lifts the bakelite yoke upward thus pressing contact *D* against contact *A*, *E* against *B* and *F* against *C*. This connects the motor to the line as shown in Fig. 13A.

Notice in Figs. 13 and 13A, that an overload trip is supplied in two motor leads. Hence, if the motor is overloaded and the overload heater elements are the correct size, the trips will cut off the current flowing to the coil and thus stop the motor. Before the motor can restart, the overload trips will have to be reset by hand.

The serviceman should make himself a test lamp as shown in Fig. 14 for use on three phase circuits. It consists of a pair of flexible lead test sockets connected in series and equipped with pair of 25 watt, 120 volt lamps. If the lamp sizes are the same, this test lamp can be safely used to test for voltages up to 240 volts.

As a further illustration of the value of Ohm's law to the electrical worker, let us divert for a moment and find out why the two lamps in this test circuit have to be the same wattage in order to insure the safety of the serviceman.

Let us suppose that a 10 watt lamp and a 100 watt lamp were used together in the test circuit.

The current through the 100 watt lamp can be found by the equation:

$$P = VA$$

$$A = \frac{P}{V} = \frac{10\text{Ø}}{12\text{Ø}} = \frac{10}{12} \text{ amperes}$$

The current through the 10 watt lamp will be:

$$A = \frac{P}{V} = \frac{1\text{Ø}}{12\text{Ø}} = \frac{1}{12} \text{ amperes}$$

The resistance of the 100 watt lamp will be:

$$R = \frac{V}{A} = \frac{12\text{Ø}}{\frac{1\text{Ø}}{12}} = 144 \text{ ohms}$$

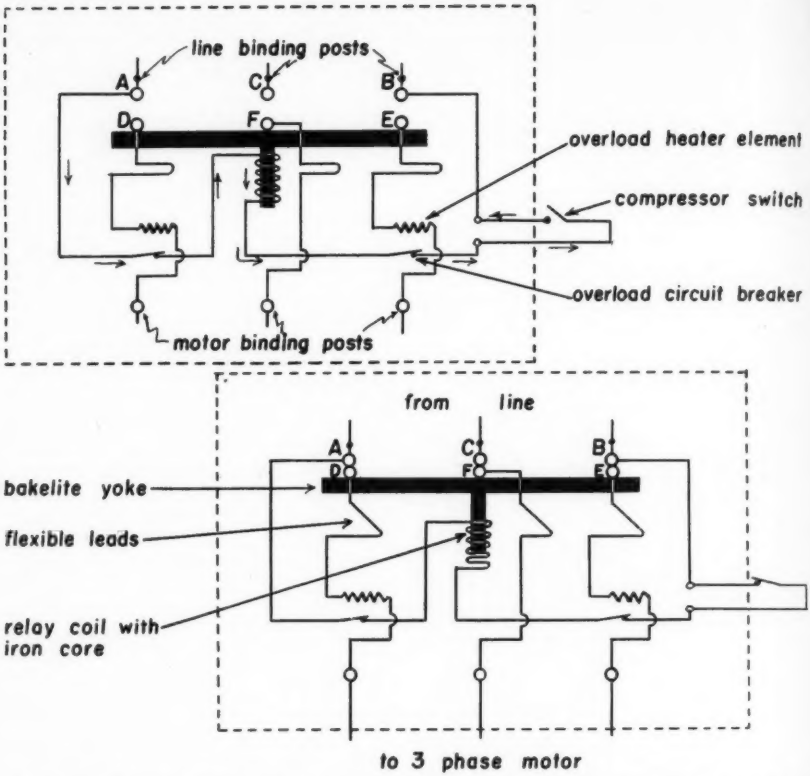


Fig. 13. Above. Circuit of Conventional across the line starter for three phase motors. Three phase line is connected to the line binding posts. The three motor leads are connected to the three motor binding posts. When the compressor switch is closed, current flows through the relay coil, magnetizes the coil and lifts the bakelite yoke so that the contacts on the yoke make up against the line contacts, thus connecting the motor to the line. In case of an overload, the overload heater elements release the overload circuit breakers and open the circuit to the coil causing the yoke to drop and stop the motor.

Fig. 13A. Below. Across the line starter in operating position.

The resistance of the 10 watt lamp will be:

$$R = \frac{V}{A} = \frac{12\text{Ø}}{\frac{1}{12}} = 1440 \text{ ohms}$$

The test circuit with lamps installed will then be equivalent to Fig. 15.

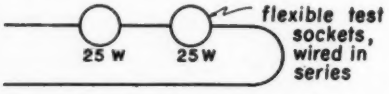


Fig. 14. Test circuit for 208 volt circuits using 120 volt lamps.

The current through the lamps will be:

$$A = \frac{V}{R} = \frac{208}{144+1440} = .13 \text{ ampere}$$

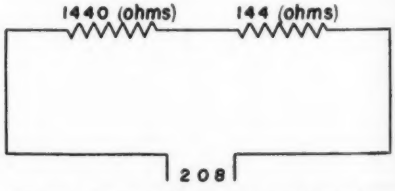


Fig. 15. Equivalent circuit for a one hundred watt lamp and a ten watt lamp connected in series on a 208 volt circuit.

The voltage drop across the 10 watt lamp will be:

$V = AR = (.13)\ (1440) = 187.2$ volts

The voltage drop across the 100 watt lamp will be:

$V = AR = (.13)\ (144) = 18.7$ volts

Hence, it can be seen that the 10 watt lamp will be subjected to a very high voltage and it is very liable to explode and painfully injure the man holding it. Many men scoff at this possibility. However, the writer has seen one man who was very badly cut by an exploding lamp, and as a result, the writer is mighty careful not to use a 120 volt lamp on high voltage circuits.

Now if both lamps are of the same wattage, they will have the same resistance. Since they are connected in series, the current flow through each will be the same. Hence, the voltage across one will equal the voltage across the other. If the test circuit is used on a 208 volt circuit, the voltage across each lamp will be 104 volts.

To be continued. Chapter 5 will deal with Trouble Shooting Methods on Polyphase Refrigerator and Air Conditioning Circuits.

SERVICE MEN SHOULD SELL SERVICE

By Thomas Coyle

Reprinted from Artic Service News

MAINTENANCE service can be sold. It will take time, of course, but look how the periodic medical and dental examination has come into being. A few years ago it was common practice to call in the doctor when you felt sick, and visit the dentist when you had a toothache. Now a regular check-up by the doctor or dentist is not at all unusual. And these professional gentlemen, without the benefits of advertising, which their ethics do not permit, actually sold these services to the public. They are still selling them—most of us get a card from our dentist or doctor every three or six months, reminding us that the periodical check-up is due. Likewise we get reminders from our haberdasher, the shoe merchant, the clothier. We don't resent these reminders; in fact, we are glad to be kept informed.

One of the best examples of how far service can be carried in a profitable way is in the servicing of an automobile. In the spring the auto owner has his car put in shape for summer driving; with the approach of winter, he has it put in shape for cooler weather. When he gets ready to go on a long trip he has his car looked over and checked. If he stops for gas, the oil, water and tires are checked automatically by the attendant. There may be nothing wrong with the car, but the owner is taking precautions against later trouble. He has been sold Service—preventative service.

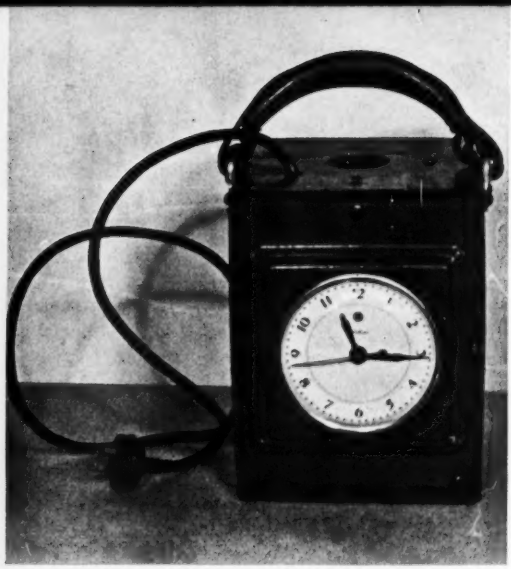
This type of service can be applied in the refrigeration industry. As every service man knows, much time on a job is spent in determining the cause, and this one item alone, perhaps, brings the most complaints from the customer. With a periodic check-up on the refrigerator the time needed to locate the trouble could be much shortened. This would go far to relieve the situation.

In the replacement of parts, automobile service has come a long way. Every reputable service garage now has a price list showing the cost of standard parts and the charge for putting them in. The customer knows in advance what the cost will be, and there can be no disputes afterwards. There is no reason why this practice could not be adopted for a refrigeration service. A special job could be classed as such and the customer given to understand that it is something outside the usual routine and requires extra time and effort.

Most service men render a bill showing what was actually done—parts repaired, replacements, etc. This bill could be expanded to include a printed list of all the parts of a refrigerator requiring inspection. In the proper place the condition of these parts at the time of the call could be indicated. The customer could be told, for example, that his fan belt was worn and if not replaced, might break and cause the motor to burn out. An inexpensive job if done now but if neglected, a probable cause of extensive damage to equipment. Everything the service man did or recommended could be shown on that work sheet, leaving it up to the customer to take the necessary action. A duplicate of the slip in the service man's files would help in diagnosing future trouble.

Every service man could leave ample evidence of the work done for his customer. The fact that the refrigerator had been put in operating condition again is not enough—it is merely proof of the service man's skill in diagnosing the cause and making the repair. A small sticker listing the wearing parts, showing the inspection date and the results of this inspection, could be pasted in the door jamb. Every time the refrigerator was opened the slip would show up as a re-

(Continued on Page 22)



Building a Running Time Indicator

Here is a practical suggestion on constructing a running time indicator to determine whether a refrigerator is operating normally. It will help to satisfy customers on power consumption.

by F. V. GOLITZ*

• Here is the shop built Running Time Indicator. A conveniently arranged time recorder for checking operating time.

THE average service man has need for an inexpensive running time indicator. Although there are instruments for this purpose on the market they are rather expensive and the service man does not feel justified in spending a large amount for such an instrument. There are times especially after a major service operation that the customer thinks that the machine operates too long or runs continuously. Unless the service man can furnish evidence that the machine is operating normally he will have either a dissatisfied customer or will be unable to collect for the job. By spending a few hours in his spare time he can construct an instrument that will indicate the total running time of a domestic machine.

Parts List:

Here are the parts required:

1—"Telechron" Square Art self-starting electric clock, 110-volt, 60-cycle
1—Relay from a discarded radio AB eliminator
1—Cord with attachment plug
1—Flush mounting single outlet
1—Carrying case—size inside dimensions, 5½"x7"x4½"
1—Carrying handle

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Make a panel of one-quarter inch plywood to cover front of carrying case. In this panel cut a 3¾ inch diameter hole with a compass saw. Drill four 5/32 inch holes in each corner of clock frame and mount in the opening of the panel. Next mount the relay in the case. A 15/8 inch diameter hole is cut in the top of the carrying case and the outlet is mounted in it so that the outlet is flush with the top of the case; drill a three-eighths inch hole in either rear corner of the top for the attachment cord. It is necessary to solder an extension to the time-reset knob and extend it out of the back of the clock in order that the clock hands may be reset on each job. The wiring sketch in Fig. 1 can be made with No. 18 fixture cord. Of course, all joints should be soldered.

Wiring Diagram

In operation: the refrigerator to be checked is plugged into the outlet *B*; the attachment plug *A* is plugged into the house outlet. When refrigerator starts the current flows through the solenoid of the relay *C* and energizes the magnet which attracts the armature, making the contact at *E*. This completes the circuit to the self-starting clock *F*. It is obvious that the clock will run only when the machine is in operation.

Set the instrument hands at 12 o'clock and write down the exact time instrument was connected in pencil somewhere on the box or on a tag attached to the instrument for the purpose. After a period of time, about

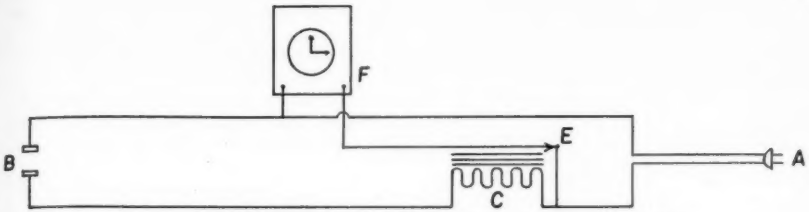


FIG. 1. WIRING SKETCHES FOR RUNNING TIME RECORDER.

eight to twelve hours later, check back on the machine; the instrument should indicate the running time. The difference between the elapsed time and the running time gives the idle or off-cycle time.

Example: The machine was started at 8:35 A. M. and the instrument was set at 12 o'clock. The machine was checked back at 4:50 P. M. The instrument indicated 3:15. The elapsed time from 8:35 A. M. to 4:50 P. M. is 8¼ hours—the clock indicates 3¼ hours running time; therefore, 8:15 — 3:15 equals 5 hours idle time.

Another method can be used by setting the instrument at the exact time the machine was started, and when checking back noting the amount the instrument is slow would indicate the idle time of the machine. *Caution*: The instrument as described is for use on domestic units operating on 110-volt, 60-cycle alternating current.

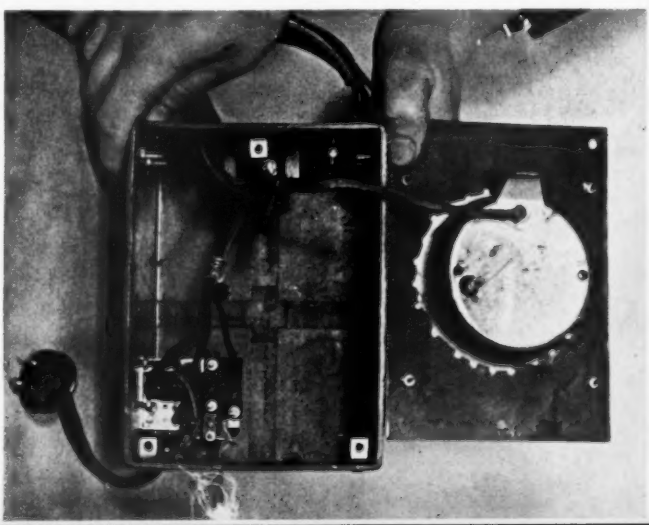
AMERICA'S KITCHENS MAKE ENOUGH ICE ANNUALLY TO MATCH ALASKA'S GLACIER

THAT Alaskan glacier that threatens to wipe out a highway and a roadhouse in the Delta River Valley hasn't much on what the housewives of America could produce in their own kitchens during the course of a year, according to figures compiled by The Temperature Research Foundation of Nash-Kelvinator Corporation.

All told, the more than 9,000,000 electric refrigerators in use in the United States could produce 304,165,450 cubic feet of ice in a year, it was conservatively estimated. A bit of geometric calculation discloses this would be sufficient for a glacier more than 2,000 feet wide, 3,000 feet long and 50 feet high. The Delta Valley ice mass reaches a maximum thickness of 3,000 feet.

The Foundation figures were based on five daily freezings of two trays of 16 cubes each. It was pointed out, however, that the great majority of modern refrigerators have larger freezing capacities and are equipped to produce far more than five freezings a day.

While on the subject the Foundation's statisticians went into a huddle, brandishing pencils and adding machines, and came up with the fact that the ice cubes produced domestically in the United States each year would pave a highway one inch thick and more than 30 feet wide around the equator —if it didn't melt before the contractor finished the job.



• Showing wiring hookup and interior of Running Time Indicator.

SELL SERVICE

(Continued from Page 19)

minder that service was available. A date for the next examination could also be included.

With a moderate charge for periodic inspection of this kind, service could be extended in the right direction. It would be spread out during the whole year and relieve some of the summer peak. Once established, this type of service could be easily merchandized. Prospects could be reminded by direct mail, telephone or in other ways. The refrigeration service engineer would be selling Service, not waiting for customers to buy. He would be in a position to get the greater part of the business which is available and being created daily through automatic refrigerator installations.

S S S

WATER SOLID AT BOILING POINT

THE strange behavior of matter under extremely high pressures is demonstrated in the new high pressure laboratory of the Armour Institute of Technology, Chicago. This laboratory is one of five now being equipped by the Institute for research purposes.

"The high pressure laboratory," says a recent issue of the *Armour Engineer and Alumnus*, "will be equipped with a rather varied assortment of pressure equipment for studying electrical, physical, chemical, and optical properties of materials under pressure as high as 600,000 pounds per square inch, or even higher.

"This equipment has already been used successfully in a great deal of very interesting work. Some of the cylinders having glass or quartz windows have been used at pressures of as high as 580,000 pounds per square inch. Under these extreme pressures, colloidal constituents are precipitated, water compresses to half its volume, and changes to a solid, having a melting point of 212° F., the normal boiling point of water.

"Glass or quartz a quarter of an inch thick will bend to a radius of curvature of four inches as many as ten times before fore breaking. Hydrogen will pass rapidly through the walls of a steel container, even though they are as much as three inches thick, and the structure of the steel is greatly affected, its tensile strength being reduced to less than half its former value.

"Under such extreme pressure the molecules are not only brought closer together but the atoms composing them are actually compressed. Gaseous hydrogen can be compressed to half the volume that the same quantity of liquid hydrogen normally occupies. Some may ask if such pressures as these are ever encountered in our everyday problems. Surprising, pressures of nearly a half million pounds per square inch exist under such commonplace conditions as thrusting the point of a needle against a piece of glass.

S S S

NEW EMERGENCY PIPE CLAMP

AN emergency pipe clamp has been developed that can be applied quickly and easily to stop leaks in pipe lines consisting of two clamps which are placed around the pipe at the leak and then driven together with a hammer, clamping down tightly on the hole in the pipe and effectively stopping leaks.

It can be applied by a mechanic or a householder in the event of a leak in a pipe in refrigerator in store or home. It is the invention of Leo Van-Gelder, an Oakland, California, inventor.

The New Emergency Pipe Clamp Developed for Stopping Leaks in Pipe Lines.

Service Suggestions *(3rd Article)* CONCLUDED

Majestic Electro-Sealed Units

This Article Continued From the February Issue Concludes the Description and Service Procedures on the Majestic Models 100 and 200 Series.

IN the January issue the various parts and general operation of the Majestic Electro-Sealed unit were illustrated and described. The February article outlined the various service troubles usually found, the symptoms and their remedies.

In this concluding article, we outline service methods and illustrate wiring diagrams as well as a thorough description of the thermostat control.

Service Methods

RUNNING TIME. The running time of the unit depends largely upon the food load carried, amount of water frozen, room temperature, opening and closing of the refrigerator door, and the relative location of the refrigerator to a stove or radiator.

It is advisable to check the temperature at the bottom of the cabinet. With the temperature control in normal position, number 1 at average room temperature, the cabinet temperatures will be approximately 40° F. to 50° F.

Place a recording thermometer in the bottom of the cabinet, and get a chart of the operating temperature over a period of 24 hours. A refrigerator that is operating in a room of 90° F. will run longer than one in a room at 70° F.

Always determine the condition under which the unit is operating; nearness to stove, steam radiator, hot air register, etc. Recommend relocation of the refrigerator if necessary.

POWER CONSUMPTION. The starting current should be approximately 13.5 amperes, and the running current approximately 3.0 amperes. The fan motor consumes approximately 25 watts.

The unit operating normally in an 85° room will consume approximately 230 watts. The wattage depends on the condensing pressure which in turn varies directly with the room temperature. In determining the wattage of a unit, sufficient time should be allowed after starting to allow evaporator to frost.

Type S. M. Thermostat for Model Nos. 100-101-102-103

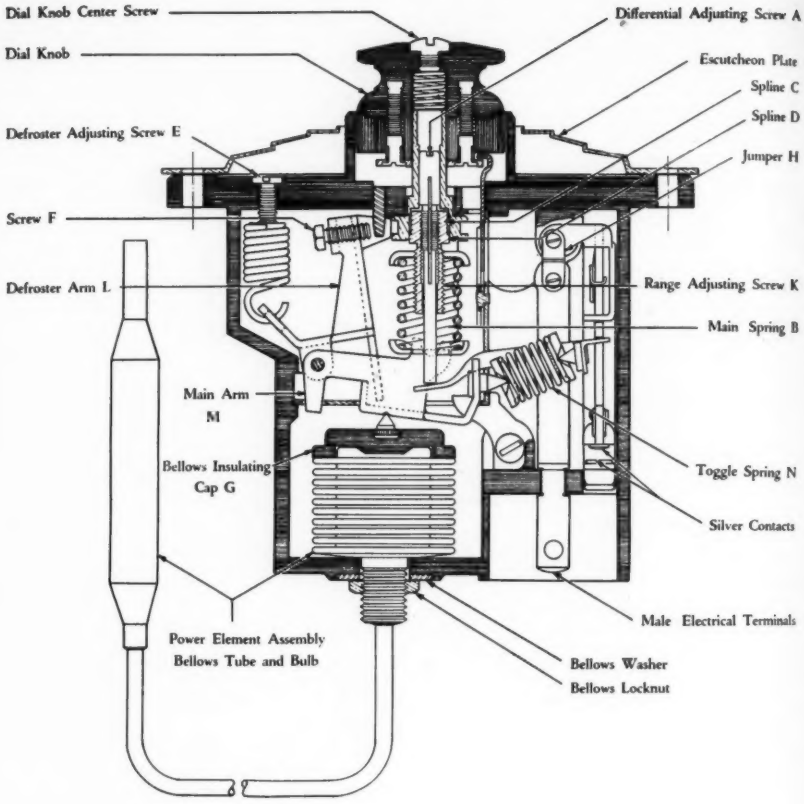
The thermostat normally will control the cabinet temperature automatically. If lower temperatures and quicker freezing are desired, they may be obtained by turning the temperature control knob, in a clockwise direction. Before making any such changes, remember that freezing of food stuffs in the cabinet may result, and furthermore the machine will consume more electricity to produce lower temperatures. Keeping these facts in mind it is well to abide by the standard setting made at the factory. (See Figure 7, Page 30 in January issue.)

Should it be necessary to adjust the thermostat to give a more desirable box temperature, proceed as follows:

TEMPERATURE ADJUSTMENT. The temperature range is adjusted by moving the pointer. A movement of the pointer from position No. 1 to position No. 5 lowers the operating range approximately six degrees. A change may be made in the temperature range by setting pointer at No. 3, then turning the pointer as many points on the dial as is required. Remove the pointer and replace to No. 3 position. Then turn pointer back to No. 1 or normal position. To raise the box temperature, turn the pointer to the left, and to lower the box temperature, turn the pointer to the right.

CONTACTS. Should contacts become badly burned, unsolder the pigtail from both the movable contact and the stationary contact panel. Replace these two assemblies.

CAUTION: See that the split nut on the



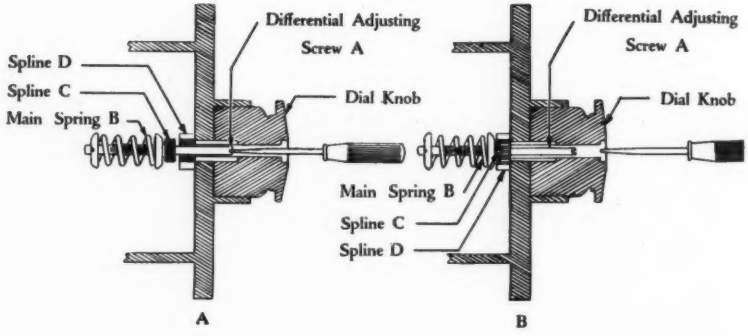


FIG. 16. TYPE D. THERMOSTAT, MODELS 205, 207 AND 209.

differential screw is in the same place on the new assembly as it was on the old.

Short Cycles. Short cycles may be due to the capillary tube of the thermostat

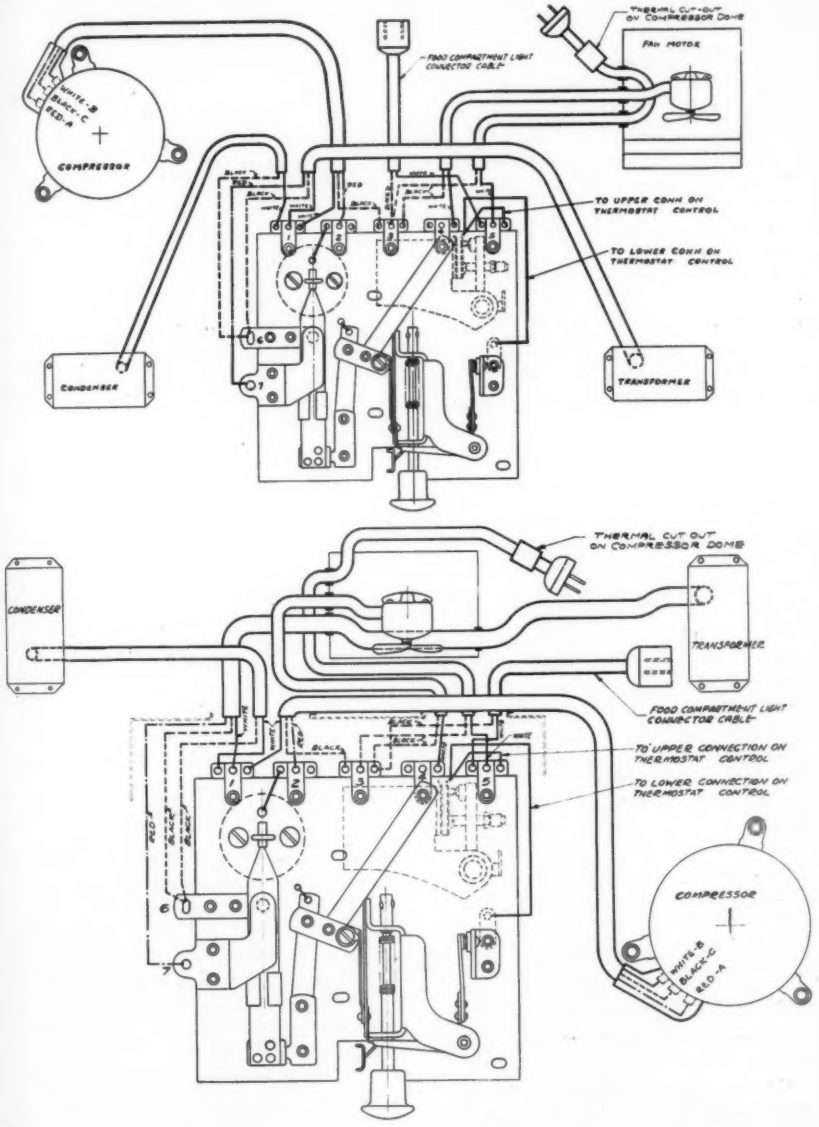


FIG. 17. ABOVE. WIRING DIAGRAM FOR MODEL 101 UNIT. CONDENSER TYPE 50-60 CYCLES, 115 VOLTS. BELOW. WIRING DIAGRAM FOR MODEL 103 UNIT. CONDENSER TYPE 50-60 CYCLES, 115 VOLTS.

touching some point of the evaporator which is colder than the bulb.

Long Cycles. Long cycles may be caused by the thermostat bulb being loose in the clamp.

Will Not Cut In. If the thermostat remains in the open or "off" position and if slight pressure only is necessary to move the over center spring yoke (see Figure 7, January issue) back and forth when the bulb is at room temperature, the charge has leaked out of the bellows assembly.

Replacement of Bellows and Recalibration of Thermostat. Equipment necessary for replacing bellows is two tall glasses of crushed ice and salt and an accurate mercury thermometer. Proceed as follows:

1. Loosen locknut on old assembly.
2. Back off threaded collar on inside of switch body until it is against bellows fitting.
3. Remove old assembly by springing it out of place with thumb.
4. Remove locknut and lockwasher from new assembly. (Do not remove from shipping clamp.)
5. Cool bulb of new assembly to 10° F. in ice and salt and remove from shipping clamp.
6. Screw threaded collar on bellows fitting and place in switch. (Do not remove bulb from crushed ice.)
7. Raise temperature in glass to 30° F. exactly and hold for five minutes.
8. Screw out threaded collar, pushing bellows in until switch kicks "on."
9. Replace locknut and lockwasher and tighten.
10. Place bulb in second glass at exactly 20° F. and contacts should open. If they do not, check upper temperature again.

If differential is too wide turn split nut down ½ turn and repeat tests.

Type D Thermostat
Model Nos. 205, 207 and 209 Units

Mounting. Mount the Type D thermostat securely to the evaporator front by inserting the switch from the back through the hole provided. Fasten the two holding screws securely. The escutcheon plate projects through the hole in the shield and is held in place by being clamped between the control and the evaporator front. (See Figure 16.)

Clamp the thermostat bulb securely in the mounting clamp. Be sure the inside of the clamp is clean and that firm contact is obtained over the whole length of the bulb. If the bulb is loose in the mounting clamp, erratic operation of the thermostat may be expected, due to uneven heat transfer from cooling unit to the bulb. It is important that no part of the connecting capillary tube touches any part of the evaporator.

Stay-Kold Defroster. Type D thermostats are supplied with defrosting mechanism (see Figure 16) arranged so that when the pointer of the control knob is turned to the "D" position, the unit will continue to operate but on a defrosting cycle. As soon as defrosting has been accomplished, the control knob pointer should again be turned to the correct operating position.

As long as the control knob pointer is in any position other than "D," the defrosting device is not in service. When turned to the defrost position, an auxiliary spring is placed in position to impose an additional resistance to the bellows movement to raise the temperature at which the switch contacts close. This defrosting spring only affects the closing temperature, and has only a slight effect upon the opening temperature. As a result, when defrosting, the cooling unit is allowed to rise to a temperature high enough to melt frost and ice before the compressor is started, yet the cooling unit temperature is brought down to approximately the same point that would be reached in normal operation.

After a few such defrosting cycles, the control knob should again be returned to the proper cold setting for normal operation. This movement of the control knob from the defrosting or "D" position to any one of the numbers on the escutcheon plate, automatically takes the defrosting device out of service so that it has no effect upon the operation of the switch.

Adjusting Defroster. As Type D thermostats are shipped, they are adjusted to start the compressor at a bulb temperature of 30° and stop it at 20° when the dial knob pointer is on position 1. When the pointer is moved to position D, placing the defrost-

ing mechanism in service, the closing temperature is raised about 8° without materially affecting the opening temperature, making the operating points approximately 20° to 38°. (See Figure 16.)

In other words, the ideal closing temperature for defrosting of 38° is obtained by superimposing a spring in the defrosting mechanism which adds 8° to the normal closing temperature of 30°, and by returning to position 1 (operating points 20° to 30°) the correct defrosting temperature is automatically obtained.

It should not be necessary to change the defroster adjustments when correcting the range adjustment for altitude, since the defroster device raises the closing point a fixed amount, 8°, and when the position 1 adjustment of 20° to 30° is regained, the proper defrosting closing point of 38° is again available.

If it is found advisable to change the normal position 1 closing temperature adjustment, it will probably be necessary to change the defroster adjustment in order to have the defrosting temperature rise to, but not exceed 38°. To do this, see Figure 16. Turn adjusting screw "E" clockwise to increase the closing temperature, and counterclockwise to lower the closing temperature. One complete turn of screw "E" represents approximately 5° change. To make adjustments turn this screw only a part of a turn and then check results, being careful not to turn so far as to throw the mechanism entirely out of adjustment.

CAUTION: Under no circumstances should screw "F" be changed as this might interfere with the proper operation of the thermostat. This is a factory adjustment which must not be changed.

ADJUSTING FOR BOX TEMPERATURE. Normal or factory setting is with the adjusting knob pointer in the No. 1 position. By rotating the adjusting knob to the right (clockwise) the range of the switch, and therefore the box temperature, will be lowered. A movement of the control knob from No. 1 to No. 9 position lowers the operating temperature approximately 8°. This "Quick Freeze" or cold control adjustment is for use between numbers 1 and 9 inclusive, and does not apply for position "D."

RANGE ADJUSTMENT. If it is desired to raise or lower the temperature at which the switch operates for any one position of the control knob pointer, this can be done as follows: (See Figure 16.)

To raise the operating temperature, turn the control knob to position No. 1, remove control knob center screw, insert small screw driver as shown in "A," and push firmly until you feel the main spring "B" compress. This removes spline "C" from mating knob spline "D" and permits free rotation of knob. Now turn knob to right (clockwise) as far as desired, then release pressure on screw driver and allow spline "C" to again seat itself as shown in "B." Turn knob back and forth a few times to insure spline cogs are properly seated. Replace center knob screw. Then turn knob pointer back to position No. 1, and the control will be operating at higher temperatures. The space between each number on the escutcheon plate represents approximately 1°.

To lower operating temperature, turn control knob from the No. 1 position as far to the right (clockwise) as it is desired to decrease the operating temperature. Insert screw driver, disengage spline and turn control knob back to No. 1 position. Allow spline to re-engage, and the switch will now be controlling at lower temperatures.

It will be noted that the method of lowering the range differs slightly from the instructions for raising the range. The reference point is in each case position 1. *To raise range,* push screw driver, turn right desired amount, release screw driver, return to position 1. *To lower range,* turn clockwise from position 1 desired amount, push screw driver, from left to position 1, release screw driver.

Do not press on the control knob when pushing with the screw driver. The knob should be free to be turned as desired.

DIFFERENTIAL ADJUSTMENT. The differential is the difference between the opening and closing temperatures of the control when the dial knob pointer is on any numeral (not on position D). (See Figure 16.)

No attempt should be made to decrease or narrow the differential unless it is greater than 10°. To change the differential, remove center control knob screw and insert screw

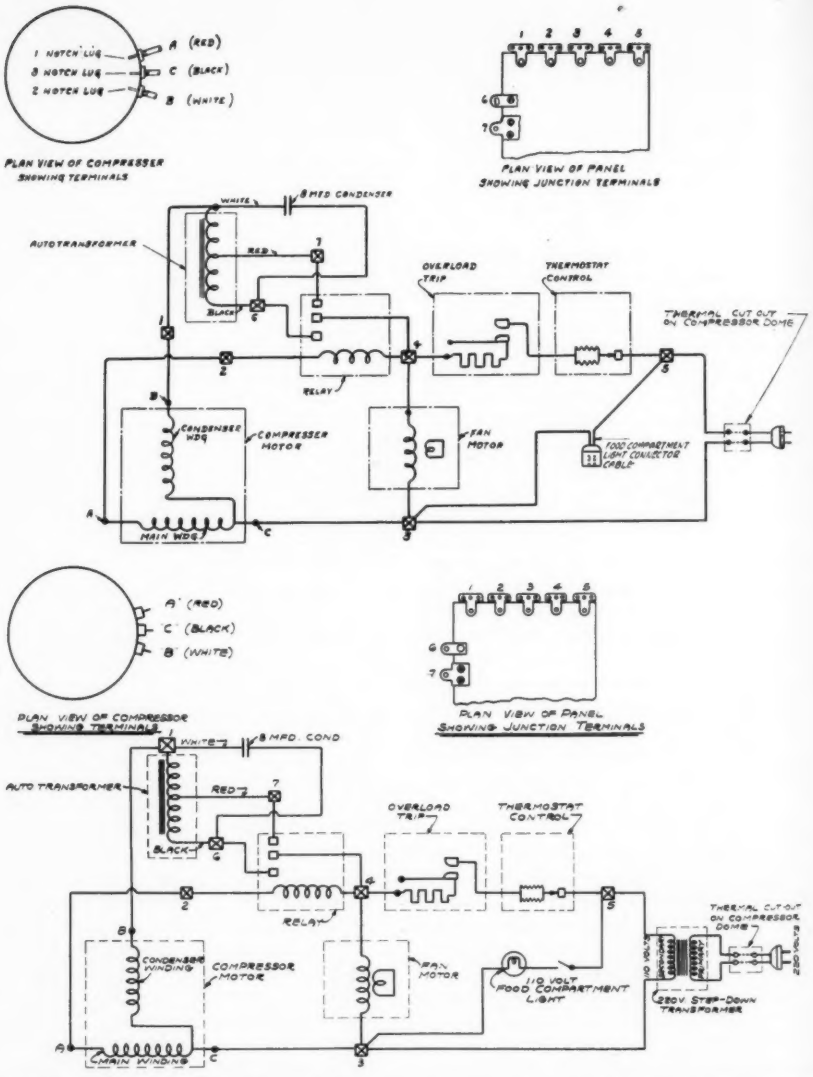


FIG. 18. ABOVE. WIRING DIAGRAM FOR MODELS 101 AND 103 UNITS. CONDENSER TYPE 50-60 CYCLES, 115 VOLTS. BELOW. WIRING DIAGRAM FOR MODELS 101 AND 103 UNITS. CONDENSER TYPE 50-60 CYCLES, 220 VOLTS.

driver, as shown in Figure 16. The point of the screw driver should be inserted in the slot of the differential adjusting screw "A."

To widen or increase the differential, turn to left (counter-clockwise). One complete turn of differential adjusting screw "A" changes the differential approximately 3°. Remove screw driver and replace center knob screw. To decrease or narrow the dif-

ferential, turn screw "A" to right (clockwise).

Changing the differential does not affect the closing point, all changes taking place at the opening point. Do not turn screw "A" more than 2 complete turns.

Examples of Adjustments. Standard factory settings for the dial knob pointer in position 1 are 20°-30°. Let us assume that it is desired to change the switch adjustments from this normal setting to 14°-26°, still in position 1. This example will illustrate how this change from standard or from any other actual setting should be made. Proceed as follows:

Since the differential adjuster only changes the opening point, it is first necessary to adjust the switch to secure the desired closing point. To do this, follow instructions in "Range Adjustment" preceeding, lowering both operating points 4° or approximately four divisions on the escutcheon plate. The control will now operate at 16°-26°. Whereas the factory adjustment is approximately 10° differential, we now desire a 12° differential so that it is necessary to widen the differential approximately 2°. To do this follow instructions in "Differential Adjustment" preceeding, turning the differential adjusting screw "A" to the left (counter-clockwise) approximately two-thirds of a turn. The switch will now operate at 14°-26°.

With this lower setting the closing temperature when the control knob is thrown to the defrost position will be too low, as by bringing the defrosting mechanism into play the temperature at which the switch closes is still raised 8°, making the operating points for the D position approximately 14°-34°. It is therefore necessary to increase the defrost closing adjustment 4° by turning adjusting screw "E" to right (clockwise) about four-fifths of a turn. See adjusting Defroster, in a preceeding paragraph. The control will now be operating at the desired temperature.

Electrical Connections. To connect electric wires to separable plug, remove insulation for approximately ½ inch from the end of each wire. Insert through the hole in connector and tie a knot with the wires inside the connector to remove strain on the connections to the binding screws in case the connector is withdrawn by pulling on the wires. Fasten each wire around its binding screw securely, making sure that there are no loose wires which might come in contact with any metal parts on the other side of the switch. Use care in inserting or removing separable connector into pocket in switch frame.

Replacing Bulb and Bellows Assembly. In order to replace the bulb and bellows assembly, proceed as follows:

1. Loosen bellows locknut.

2. Press down on top of bellows insulator cap with both thumbs to collapse bellows and then slide assembly forward out of the case.

3. As received, the new bellows has a metal clamp to hold the bellows compressed. *Do not remove this clamp* until the temperature of the charge has been reduced, relieving internal pressure. Place the bulb in a mixture of crushed ice and salt until the bulb temperature, as measured by an accurate thermometer, has been reduced to 10° F. or less.

4. When everything is in readiness, remove the shipping clamp. Holding the bellows compressed with the fingers, slide into place in the switch. Make sure that the insulating cap "G" is in proper position.

5. Replace bellows washer and locknut; tighten securely but make sure not to break switch case.

6. Mount switch and bulb in unit as mentioned above and check the operation, making any changes in adjustment that are necessary.

Will Not Cut In. The cutting in of the thermostat will not start the motor if there is an open circuit in the wiring.

The switch will not cut in if the bellows has lost its charge. This may be determined by depressing the bellows with the thumbs on the bellows insulating cap (Figure 16) when the bulb is at room temperature. If only slight pressure is required the bellows has lost its charge.

Short Cycles. Short cycles may be due to the capillary tube of the thermostat touching some point of the evaporator colder than the bulb.

LONG CYCLES. Long cycles may be due to the thermostat having its range so low that the machine operates inefficiently. Long cycles may also be caused by the thermostat bulb being loose in the clamp.

WILL NOT CUT OUT. The thermostat will not cut out if the temperature range is set below the ultimate limit of the refrigerating system, or the evaporator temperature cannot be lowered sufficiently to maintain correct box temperature. A short circuit in the cable connected to the thermostat will prevent the motor from being stopped by the operation of the thermostat.

Electrical Tests and Adjustments

Use of the Premier Test Panel (See Fig. 15)

CAUTION: In testing the electrical equipment, the refrigerator must be disconnected from the wall receptacle before the test panel is connected. Serious burns may result if this precaution is not taken!

Model No. 100 Unit

TEST FOR PILOT LIGHT CONTACT. With the test clips on lugs "A" and "B" throw switch marked 13 to "on" position, adjust to 13.5 amperes. The overload trip will now go through a complete cycle, and will lock itself in an "off" position, whereupon the pilot light should glow when unit is plugged into receptacle.

CAUTION: Disconnect test panel before plugging into receptacle! (See Fig. 15.) February issue.

TEST FOR OVERLOAD TRIP. With flexible leads from test panel on lugs "A" and "B" (see Fig. 15) turn the switch on the panel marked "7 amps." to the "on" position. Adjust rheostat so that 7 amperes exactly are flowing through heater. Under these conditions, the overload mechanism should trip off, in from 30 seconds to two minutes. If mechanism requires more than two minutes to kick off, bend the *bracket* holding the bi-metal blade outward.

CAUTION: Never bend the blade itself! If the trip takes less than 30 seconds to trip off, bend the bracket in the opposite direction. Be sure to re-test the trip after each adjustment.

TEST FOR RELAY. The relay weight should be adjusted to such a position that when the weight is up against the bottom of the coil spool, the rubber insulator on the end of the arm will be in the center of the screw eye with the upper contact closed. This adjustment should be made before the relay is tested. Connect test leads to "C" and "D" (see Fig. 15) on control panel and throw switch marked "7 amps." to the "on" position. Use the rheostat to vary the current, flowing through the coil. Adjust relay arm so that upper contact is made at 7.5 amps. Then reduce current to 6 amps. and lower contact must "make" without buzzing. All adjustments on the relay are to be made by bending the bracket holding the relay arm from which the weight is suspended.

TEST FOR PHASE SHIFTING TRANSFORMER. Switch flexible leads on test panel to the two binding posts marked "CONT" and throw the switch under the bulb to the "on" position. With the two clips, the two windings of the transformer can be tested for opens, grounds and shorts.

TEST FOR ELECTRICAL CONDENSER. Disconnect one lead of each condenser block from the narrow terminal board inside the condenser can. With test panel as above, clip the two leads of one condenser to the flexible leads from the test panel. The following degree of brilliancy of a 15-watt pilot light bulb will show the condition of the condenser block.

No light—open. Half lighted—OK. Full light—shorted.

Repeat test with the other block.

MODEL NOS. 101 AND 103 UNITS—TEST FOR OVERLOAD TRIP. Connect flexible leads from test panel to lugs 4 and 5 (see Fig. 15) and throw the switch marked "7 amps." to the "on" position. Overload trip should kick off in 45 seconds to one and one-half minutes. Adjustments are made by bending the bracket which holds the bi-metal blade and heater assembly. If the trips kick off too soon, bend the bracket so that the blade presses tighter against the stop on the frame. If the trip does not kick off soon enough, bend the bracket in the opposite direction.

TEST FOR RELAY. Connect flexible leads from the test panel to lugs "2" and "4" (see Fig. 15). Test and adjustments are the same as for the Model No. 100 unit.

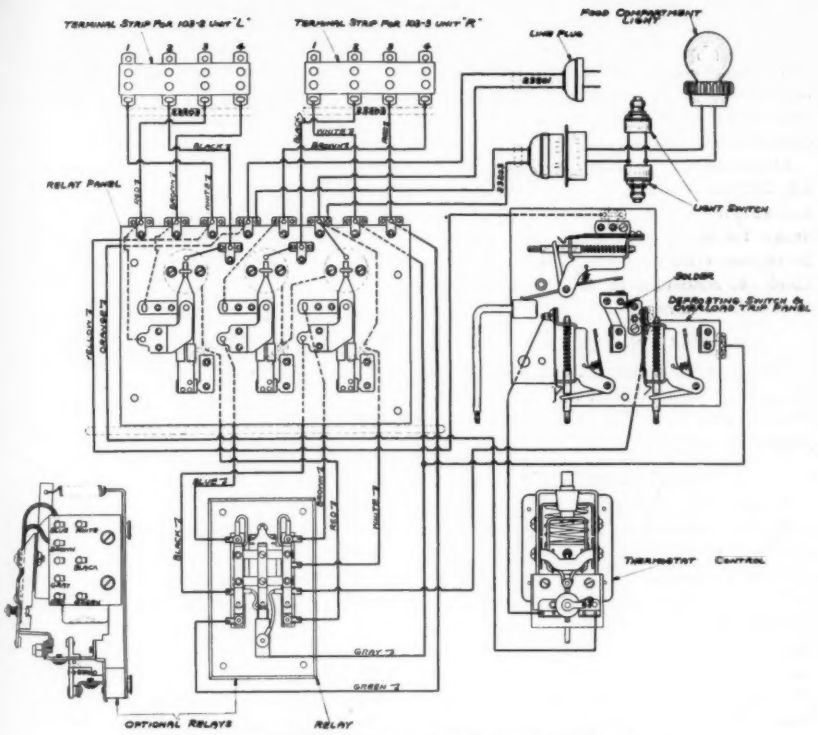


FIG. 19. WIRING DIAGRAM, MODELS 103-2 AND 103-3.

TEST FOR PHASE SHIFTING TRANSFORMER. Connections and tests are the same as used on the Model No. 100 unit.

TEST FOR ELECTRICAL CONDENSER. Since there are only two leads to this condenser, it will be necessary to use a 40-watt bulb instead of the 15-watt bulb used on test of the Model No. 100 condenser. Test is otherwise the same.

MODEL NOS. 205, 207 AND 209 UNITS—TEST FOR OVERLOAD TRIP. Connect flexible leads from test panel to lugs "5" and "7" (see Fig. 15) and throw switch marked "7 amps." to the "on" position. Adjust rheostat so that exactly 7.5 amps. are flowing through the heater. The overload should open in 45 seconds to one and one-half minutes. Any adjustment necessary should be made as follows: At the end of the bi-metal blade and situated between the line cord lugs is a machine screw slotted at the top. This is the overload trip adjusting screw. It is soldered to both the overload trip bracket and to a locking nut at the panel. To adjust proceed as follows: Hold a soldering iron to the locking nut to melt the solder and back this nut up about one turn. Now hold the soldering iron to the bracket until the solder is melted and turn the screw with a small screw driver. Turn clockwise to increase the time required for the switch to open. Turn counter-clockwise to decrease the time. *Tighten and re-solder the locking nut before re-testing the trip.*

TEST FOR RELAY. Connect flexible leads to lugs "4" and "7" (see Fig. 15) and throw switch marked "7 amps." to the "on" position. Use the rheostat to vary the current. This relay has only one set of contacts and these contacts should close without buzzing with from 7 to 7.5 amps. flowing through the coil. To adjust relay proceed as follows:

Hold soldering iron to relay adjusting screw at end of spring until solder has melted and turn screw with a screw driver. If contacts close under 7 amps., turn clockwise. If contacts do not close at 7.5 amps. or under, turn counter-clockwise.

ELECTROLYTIC CONDENSERS MODELS NOS. 205, 207, 209 UNITS. The Premier Tester is not adapted to check the electrolytic condenser for shorts or grounds. It is advisable to replace condenser with a new part and check old condenser on another unit that is known to be normal.

Model No. 102 Unit

The electrical equipment on the Model No. 102 unit is similar to that used on the Model No. 101 and 103. The same tests and adjustments apply.

Special Power Supply

Models Nos. 100, 101, 102, 103, 205, 207 and 209 Majestic refrigerator units will operate on 50-cycle, single-phase current without alteration. Standard voltage is 110 volts. A double wound step-down transformer can be connected to all models so that they may be used on 50-60-cycle, single-phase, alternating current lines of 140 volts or over. These transformers should be obtained from the factory.

Instructions for Replacing Fan

Remove fan housing cover and the old fan. Unsolder fan lead connections on control panel.

Mount the adapter plate with the bosses upward in the same relative position occupied by the old base and use the same rubber washers, rubber thimbles, special washers and nuts.

With these preliminaries done the actual mounting of the fan is facilitated.

In order to get the fan assembly into the fan housing, it is necessary to insert the fan with the fan blades down.

General Service Practice and Instruction

PRESSURE GAUGE CONNECTIONS. To obtain the head pressure reading of Models Nos. 100, 101, 102 and 103, install pressure gauge on oil charging line extended from base of compressor.

Pinch off oil line carefully. Cut off end of tubing leaving pinch-off tool in place. Install ¼" flare nut and attach shut-off valve and pressure gauge. Remove tool and carefully open pinch-off until pressure is indicated on gauge.

To remove valve and gauge, pinch off line and cut off flared end of tube. Seal end of tube with solder and remove tool.

In case it becomes necessary to obtain the vacuum reading on the low side, install compound pressure-vacuum gauge on charging line at rear of evaporator. Proceed as outlined above.

To obtain head pressure reading on Models Nos. 205, 207 and 209, install service valve and gauge on the charge fitting located on the float valve chamber. See Fig. 9, January issue.

To install service valve, remove sealing cap with soldering iron. Install valve and tighten securely. Attach gauge and open valve needle slightly. After valve has been removed, replace sealing cap and re-solder.

DISCHARGING LEAKY UNITS. Before returning a leaky unit, discharge the system to prevent escape of SO_2 or oil during shipment. To discharge Models Nos. 100, 101, 102 and 103, attach hand valve to oil charge line as explained under "Pressure Gauge Connections." After the unit has been discharged thoroughly pinch off line to prevent corrosion. The unit can be kept in an upright position while discharging.

To discharge Models Nos. 205, 207 and 209 attach service valve to dome charging fitting. Lay unit on side, so that it rests on the edge of the mounting plate with the SO_2 condenser nearest the floor. This will discharge the oil completely. After the unit has been discharged the needle valve should be closed.

PURGING UNITS. To purge Models Nos. 100, 101, 102 and 103, unsolder the cap on the purge fitting located at the SO_2 condenser. Allow unit to stand idle for approximately 15 minutes. Loosen purge needle slightly to allow the air to escape. Use a swab saturated in 28% ammonia to determine when air has escaped and sulphur dioxide is discharging. After the purging has been accomplished, reseat needle and re-solder cap.

To purge Models Nos. 205, 207 and 209 unsolder caps on charge fittings, located on

FIG. 38. WIRING DIAGRAM MODELS 103-2 AND 103-3 UNITS.

top of the float valve and dome. Purge dome fitting first, followed by float fitting. Use ammonia to determine when air has escaped. In all cases re-solder cap to prevent leaks. Avoid use of excessive solder and determine that vent hole is closed.

REMOVING UNIT FROM CABINET. Whenever it becomes necessary to remove a unit from the cabinet, a unit lifter and bar or hoist must be used in order to prevent damage to the unit. Under no condition should a unit be removed by attaching a rope or strap to the tubes.

On all models remove unit mounting plate hold-down screws. On the Model No. 100, disconnect the flexible shaft from the cold control pointer. On the Models Nos. 101, 102 and 103, disconnect the control box from the cabinet, by first removing the escutcheon plate.

On the Models Nos. 100, 102 and 103 the unit mounting plate is provided with three studs to which the three unit lifting rods must be securely fastened.

On the Models Nos. 101, 205, 207 and 209 there are two studs in the unit mounting plate to which the unit lifting rods should be attached. Care should be taken by the service man when removing a unit, not to bend any copper tubings or to damage the unit or porcelain food liner. Care should be taken when new unit is installed in the cabinet that the sponge rubber gasket as well as the rubber gasket under the unit mounting plate are in place.

AIR CONDITIONING BOOM ON WAY KELVINATOR CONFERENCES REVEAL

AIR conditioning is a "first" on America's list of demands for 1937. A 6,500 mile tour of the West Coast by five national officials of the Kelvinator Division of Nash-Kelvinator Corporation revealed a rapidly increasing demand for air conditioning, both residential and commercial, along with corresponding markets for improved commercial refrigeration and automatic heating products.

Representing the first large manufacturer of air conditioning to take its merchandising story direct to the field in conferences with its commercial distributors, Kelvinator's five Commercial Division executives conducted a series of four regional meetings in Portland, Ore., San Francisco, Los Angeles, and Dallas during the first two weeks in February.

Despite a 21-inch snowfall in Portland and a serious "flu" epidemic in Dallas, attendance at all four conferences was above expectations. More than two hundred and fifty western Kelvinator distributors and their sales representatives attended the western meetings.

Reports of the four Kelvinator Commercial Distributors conferences indicate a definite upturn for 1937 in general merchandising and advertising activity, according to J. A. Harlan, Kelvinator Commercial Division Manager, who was in charge of the western delegation from Detroit. Speaking in Los Angeles, Mr. Harlan stated, "In my many trips to the Coast I have never seen prospects for business as splendid as now. The settlement of the maritime strike is releasing a large amount of business dammed up for the past few months. Definitely, sentiment is highly optimistic on general business conditions."

The announcements of enlarged merchandising programs and advertising plans for the coming year, highlighted the Western Conference programs. Both are the most extensive ever attempted in the western area. The West will share heavily in the national Kelvinator advertising budget for 1937, which includes a coast-to-coast radio program for the first time. Increased emphasis will be placed on newspaper and magazine space in that section.

The Kelvin Home movement, originated by Kelvinator to bring a completely electrically equipped home with year-round air conditioning within reach of families of moderate income, met with enthusiastic approval at each conference. Mr. Harlan predicts that twice as many American families this year as last will air condition their homes, and that 5,720,000 owners of homes already electrified will demand air conditioning within ten years. Mr. Harlan also anticipates at least a one hundred per cent national increase in commercial air conditioning installations this year.

According to Mr. Harlan, the conferences left no doubt that commercial installations remain the "backbone of all refrigeration." The fallacy of high market saturation beliefs was exploded by Conference surveys which revealed a growing replacement market for commercial refrigeration with new markets for both small and large units. Im-

(Continued on Page 52)

The Use and Cutting of Gaskets

By L. K. WRIGHT, Mem. A. S. R. E.

Every service man has experienced trouble with leaky gaskets. It is most important that gaskets which are replaced are made of the proper material for the service required and are properly shaped. This article tells how to select material and cut gaskets.

THE only reason refrigeration apparatus is employed is to conserve the refrigerant, so as to enable the charge to be used over and over again with as little loss as possible. Under proper operating conditions no dissociation of the chemical constituents of the refrigerant will occur and it can be used over and over again without breaking down into its component elements.

Theoretically no loss of refrigerant occurs, but in practice it is known that at all joints where a metal to metal contact is used or where a gasket material is compressed between two metallic faces a tiny leakage results. Porous welds and cast metals are notorious as points of leakage. The modern refrigerating machine manufacturer makes use of drawn, extruded or forged parts to avoid leakage due to porous metal.

Saving Refrigerants

If refrigerants were cheap that part of the refrigerating apparatus comprising the motor, compressor, condenser, receiver and suction line could be eliminated, as only the throttle device, a liquid line and an evaporator would be required, such as shown diagrammatically in the accompanying sketch, Fig. 1. This would be wasteful of refrigerant for it would only allow the material to absorb heat and escape to the atmosphere as a vapor, bearing with it the heat absorbed when changing from a liquid to a vapor in the evaporator or cooling coil.

Leakage of refrigerant from a system is wasteful and costly. Hence, the desire to eliminate the cost involved in replacing refrigerant. To make for ease in construction, assembly and servicing various parts are designed with gaskets between the sections. It is important the gasket used be of the correct material and be properly shaped.

Various materials are made use of in the manufacture of gaskets, each having certain characteristics not found in others. Included in a list of materials would be found diaphragm cloth, compressed cork, asbestos, rubber, copper, lead, paper, steel, celluloid, leather and the newest addition, Duprene.

Molded and compressed sheet cork was used in some of the older expansion valves. It is affected by oils and refrigerants and its use was limited for this reason to locations where it is not contacted by these fluids.

Asbestos, rolled into sheets with a binder, such as oxidized oils or rubber is widely used, especially in sulphur dioxide systems. If rubber is used as a binder this material cannot be used with ethyl chloride, methyl chloride, Isobutane, F-12, Carrene or F-114, as these refrigerants will dissolve and remove the rubber and leave the asbestos in a porous and leaky condition.

Rubber is used to an excellent purpose on water joints, but not on refrigerant lines, except ammonia and sometimes on carbon dioxide, although the high pressures encountered where the latter is involved may result in the packing blowing out unless the flange is expressly designed for rubber stock.

Copper finds use as a washer-packing under bolt heads, on plugs with flat or formed seats and of course is widely used for refrigerant lines, involving the use of a flare for sealing purposes. Certain gaskets, known as the McKim type, consist of a core of asbestos partly encircled with soft copper. These are used where S. A. E. flared ends must be united and where a compressible packing is necessary, so that valves or other fittings can be screwed in for proper alignment with other fittings or valves. Copper, or its alloys, cannot be used on ammonia systems, unless this refrigerant is thoroughly anhydrous.

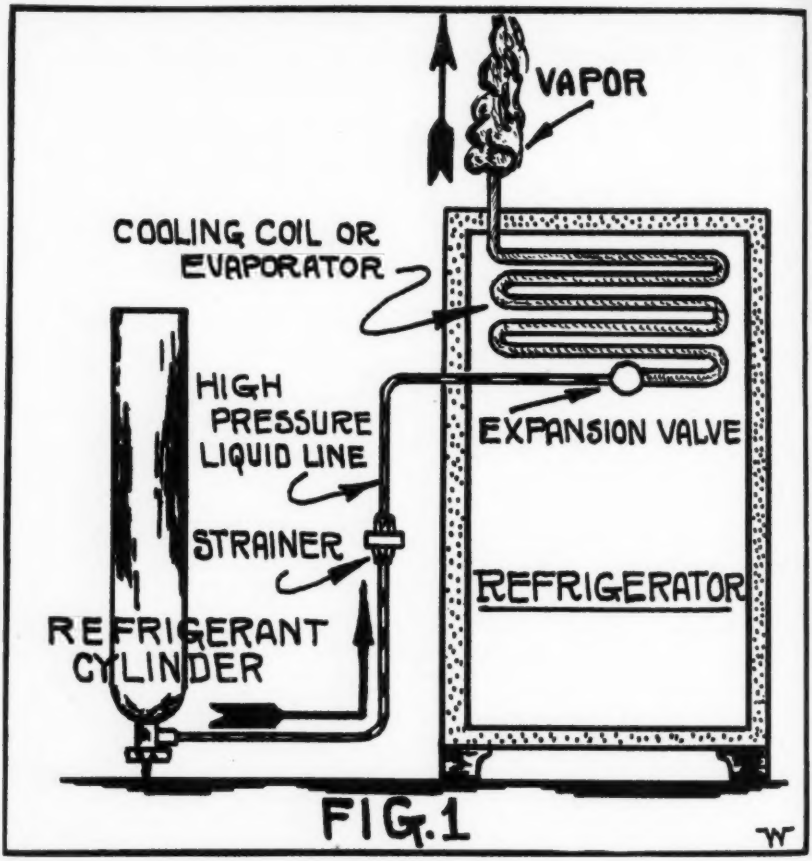


FIG. 1. HERE IS THE TYPE OF REFRIGERATING SYSTEM WE WOULD USE, IF WE DID NOT NEED TO WORRY ABOUT THE COST OF REFRIGERANTS.

Lead is widely used as a gasket material. It is excellent for the purpose, for it "flows" under pressure and gives a tight joint. As it is unaffected by refrigerants or oils it can be used on any refrigeration system, as well as for water lines. The majority of metal gaskets are cut from a special matte finish material (R. M. Metal) which is composed of a mixture of lead, tin, antimony and copper. This material seals and stands up somewhat better than plain lead due to the alloying and to the special finishing of the surface.

Paper is used on water lines and in other places where refrigerant is not to be retained. Its use is limited.

Steel, in the form of a gasket shaper is used on some Frigidaire assemblies, being placed between two thin lead gaskets. Its purpose is to provide even distribution of pressure and better sealing. Unlike other gaskets the steel section is not compressed.

Celluloid finds limited use as a gasket material, generally being employed with service valve adapters and test or charging equipment, where the gasket is used only temporarily.

Leather is employed to some extent on water line joints, although ground unions are replacing the gasket type of union and fewer gaskets of this type are used than in previous years.

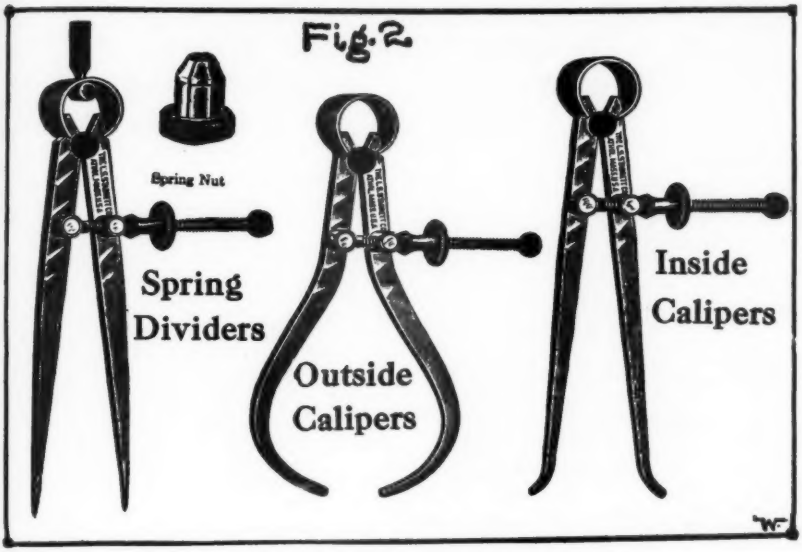


FIG. 2. TYPES OF CALIPERS FOR MARKING GASKETS.

Duprene gasketing is composed of an artificial rubber and is impervious to refrigerants or oils. Material sold under the name of Duprene and other trade names is finding extensive use in the lining of flexible hoses for oil lines, for use as resilient sealing gaskets on shaft seals and for general gasketing. Because of the resilient rubber-like appearance it is often confused with true rubber, but the latter will dissolve in oils and certain refrigerants such as F-12 and methyl chloride, whereas the former is impervious.

Gasket Stock

The average service station is obliged to stock a great number of gaskets, in lead and asbestos, for convenience where overhauling jobs are concerned. The man in the field and especially on distant jobs, cannot carry a great supply of gaskets and therefore has to rely upon his ability to fashion them as required. This is especially so on some of the older, obsolete models, for which it would not pay to stock gaskets or for which gaskets are no longer available.

Inasmuch as lead can be used with any refrigerant and under all conditions sheet stock can be carried so that gaskets can be cut from this supply as required.

Without question the best material is matte finish R.M. metal. For cylinder head to valve plate gaskets a very thin sheet should be used, viz.: between .008 inch and .010 inch. A .005 inch is a splendid thickness. Bear in mind to use this thin metal for cylinder head to valve plate gaskets. Thicker stock is sometimes required under special conditions, especially where piston projects above the cylinder. Where the piston is flush with cylinder top use the thinnest gasket for best results, for there is less clearance and less re-expansion of gas. This makes the compressor more efficient.

For valve plate to head, cylinder to crankcase, sylphon or seal, end plate, bottom plate and end cover gaskets, as well as the general run of gaskets used between flanges, use .010 inch to .015 inch stock.

Gasket Tools

A regular gasket cutting kit can be purchased, having large straight and curved blades or cutters as well as hollow punches of various sizes. Hollow punches are excellent and can be made by taking a piece of steel tubing of the desired diameter and filing or grinding the end to a sharp edge. In grinding do so slowly and keep cool by dipping in water so as not to "burn" the metal. Revolve the tubing while grinding to an edge to obtain an evenly ground punch.

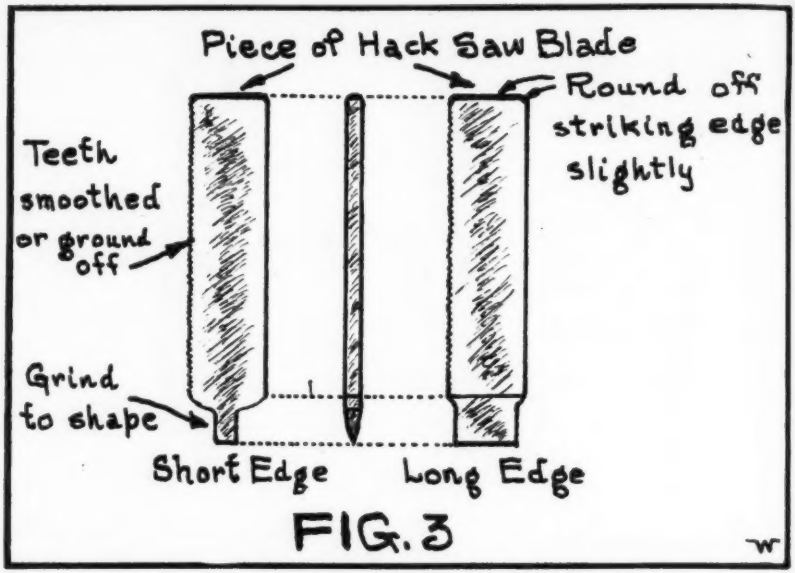


FIG. 3. HACK SAW BLADES GROUND TO CUTTING EDGE.

It will be found, however, that any gasket can be cut and formed with only a piece of hack saw blade, spring dividers and outside calipers. An inside caliper may be included in the list if desired, but most work can be done without either inside or outside calipers. Calipers and dividers are shown in Fig. 2.

To make cutting chisels, break off pieces of an ordinary hack saw blade in a vise. These sections should be about two inches in length. If longer they develop a certain amount of spring and may crack in use.

Grind one end of the piece of hack saw blade to a flat striking surface, with the edges rounded, as shown in the illustration (Fig. 3). The cutting edge is best ground as shown in the sketch. Several of these cutters can be made. For instance it may be found handy to have one with a long cutting edge and others with smaller edges.

Dividers of a substantial pattern should be selected. Weak, spindly legs will result in poor gaskets. One leg should be left with a well rounded, pointed end. The other must be cut to a chisel or cutting edge. Fig. 4 shows the ends, *A* representing the round end and *B* the sharp cutting edge. *C* shows a side view of this cutting edge. Some dividers are provided with spring nuts for

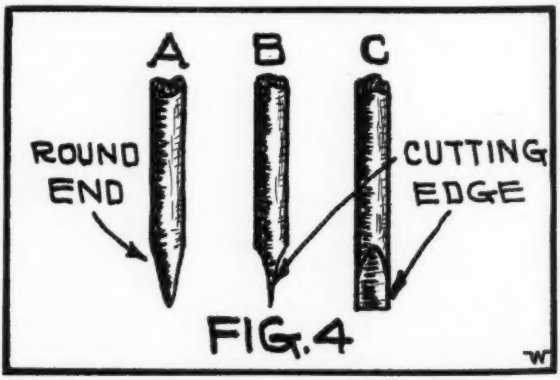


FIG. 4. DIVIDERS FOR CUTTING GASKETS.

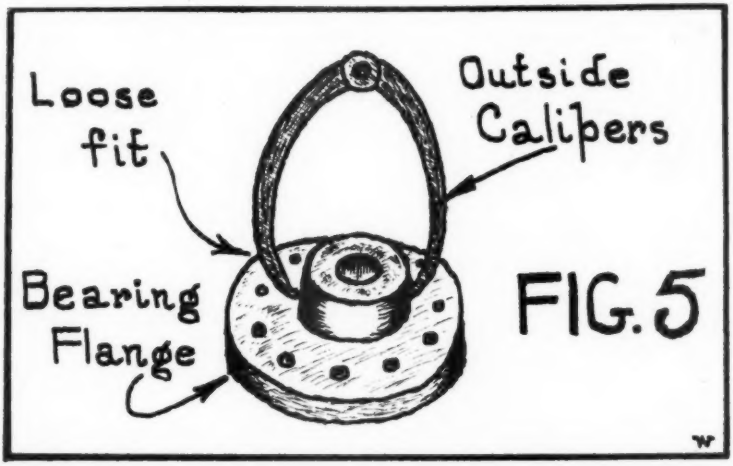
rapid adjustment, but the plain nut serves equally well.

Cutting Gaskets

For a regular assignment assume a flange plate or blind bearing is to be provided with a gasket. Proceed by using outside calipers as shown in the sketch to get the diameter of the projecting section. In all cases be sure to get a loose fit. See Fig. 5 for this.

Use dividers and adjust so as to get exactly half of the diameter secured with the outside calipers, as per indicated data shown in Fig. 6.

Place a sheet of lead or asbestos on a flat surface. As a rule the lead sheet is carried in a roll. Unroll the stock carefully. If dented lay as flat as possible on a flat surface such as a smooth board or table surface and pat it smooth with the hand. Do



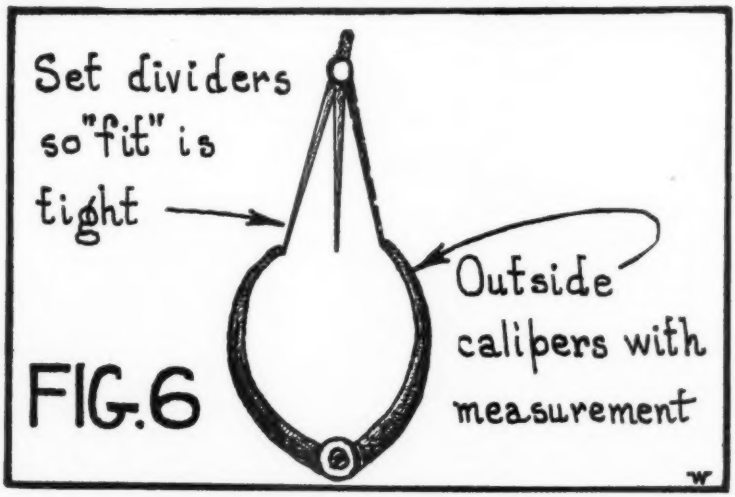
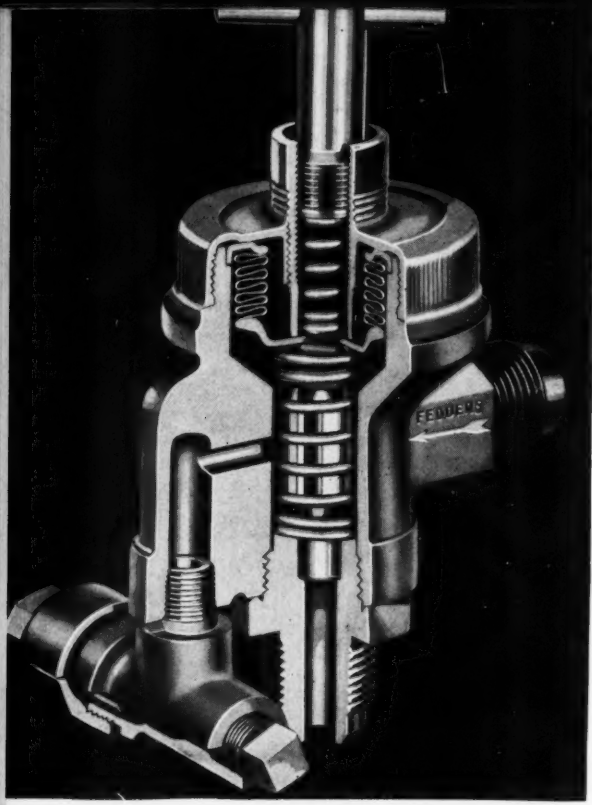


FIG. 5. CALIPERING FLANGE PLATE FOR GASKET MEASUREMENT.
FIG. 6. USING DIVIDERS TO SECURE MEASUREMENT.



Cutaway view of Fedders Model CP-35 Constant Pressure Valve showing .3125" Needle-Seat Orifice and large refrigerant passageways assuring minimum pressure drop. Note convenient T handle Adjusting Stem and Shut-off valve for gauge.

FOLLOWING DATA ON PRESSURE DROP AND CAPACITIES BASED ON TESTS USING FREON				
Capacity— B.T.U. per Hour	3000 B.T.U.'S	6000 B.T.U.'S	9000 B.T.U.'S	12000 B.T.U.'S
Pressure Drop in Lbs. thru CP-35 valve with ½" or ⅝" S.A.E. male flare connections	1.0 Lbs.	1.6 Lbs.	3.0 Lbs.	8.5 Lbs.

How F

Give Performance

Refrigeration men ever where coming the Fedders Constant Valve as a simple, easily installed, cal and extremely accurate means trolling each unit in a multiple syst cooling units necessarily operating ous loads and temperatures.

They are also used on single inst where operating conditions req tremely accurate control

The diagrammatic sketch belo where and how Model CP-35 Const sure Valves are installed in a typ taurant or drug-store hook-up.

The valve controls the pressu extremely close limits measured i

FEDDERS MANUFACTURING C

57 TONAWANDA ST. **BUFFALO, N**

Atlanta, 175 Luckie St., N. W. Cincinnati, 305 E. Sixth Street Los Angeles, 1501 W. Eighth St. Philadelphia, 2100 A
Boston, 712 Beacon Street Chicago, 603 W. Washington Blvd. Dallas, 209 S. Pearl Street New York, 116 E. 16t

ARE YOU GETTING YOUR COPY OF THE FEDDERS NEW

FEDDERS

CONSTANT PRESSURE

VALVES

ormance Insurance on Low Side Hook-ups

nen everywhere are wel-
dders Constant Pressure
easily installed, economi-
accurate means of con-
in a multiple system with
ssarily operating at vari-
peratures.

ed on single installations
conditions require ex-
control

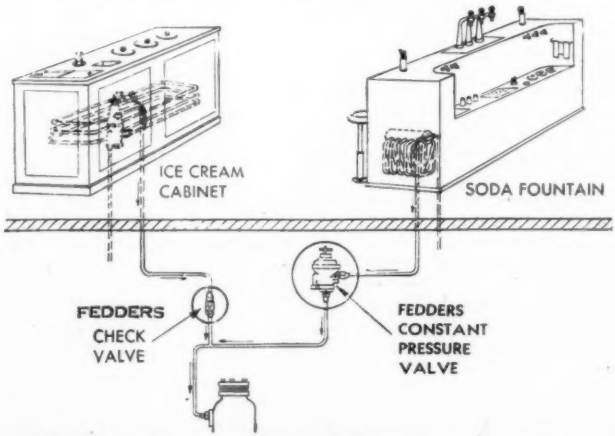
tic sketch below shows
del CP-5 Constant Pres-
stalled in a typical res-
tore hook-up.

ols the pressure within
its measured in ounces.

A convenient shutoff valve with gauge connection is standard equipment to make it easy to obtain the desired setting by means of the T handle adjusting stem of the valve.

Helpful information on the uses and application of Fedders Constant Pressure Valves is given on Pages 9, 11, 14, and 21 of Joe Askin's book, "Refrigeration Engineering and Service Articles," also on pages 36, 37, Bulletin 75-D.

Recommended and sold by Representative Suppliers everywhere.



Typical installation of Constant Pressure Valve. Also Note location of Fedders Check Valve.

NG CO.
FFALO, N. Y.
Philadelphia, 2100 Arch Street
New York, 114 E. 16th Street

RS NEWS?

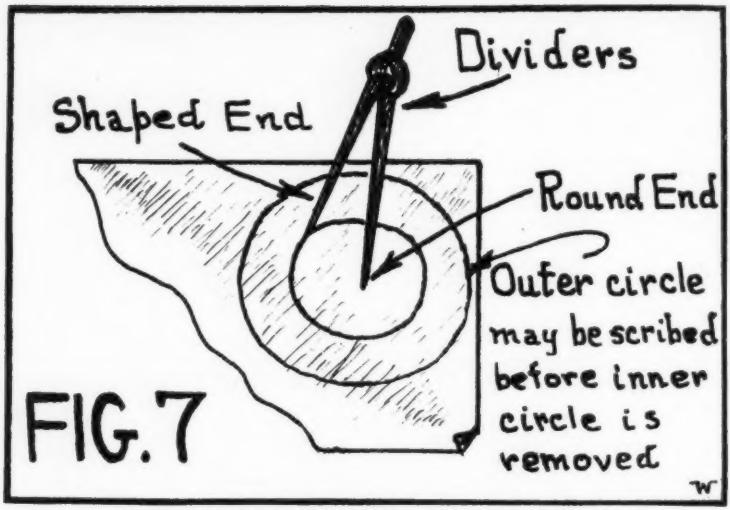


FIG. 7. CUTTING GASKET USING CUTTING DIVIDERS.

not use a hammer. See that no dirt, filings or metal chips are on the table as these may become embedded in the material and prevent the gasket from holding when installed.

Take the dividers and force the round end to seat in the metal sheet, judging the size of the gasket so that little waste will result. Then revolve the dividers, holding them steadily so that the round leg remains in the center hole and that the cutting edge cuts into the sheet. Too much pressure will cause a jumpy, ragged cut to be made. If used correctly a smooth cut will result and the entire center section can be lifted out. This application is shown in Fig. 7.

The flange plate can now be inserted in the hole in the gasket (Fig. 8). The outer diameter can be scribed with a sharp point or pencil and each bolt hole can be similarly scribed. Take care to get the bolt holes carefully scribed. If carelessly done the holes will not be centered properly and will be oval in shape.

Remove the marked gasket and if possible lay on the end of a piece of timber, such as a two by four or other timber. Using a cutter formed from a hack saw blade or the end of a sharp knife, punch out the bolt holes. Do not cut these with a sliding motion. Use the knife or punch for piercing and by a series of connecting perforations cut the bolt holes out of the sheet.

A pair of snips or scissors can then be used to trim the outer circumference to the desired diameter, as scribed on the sheet.

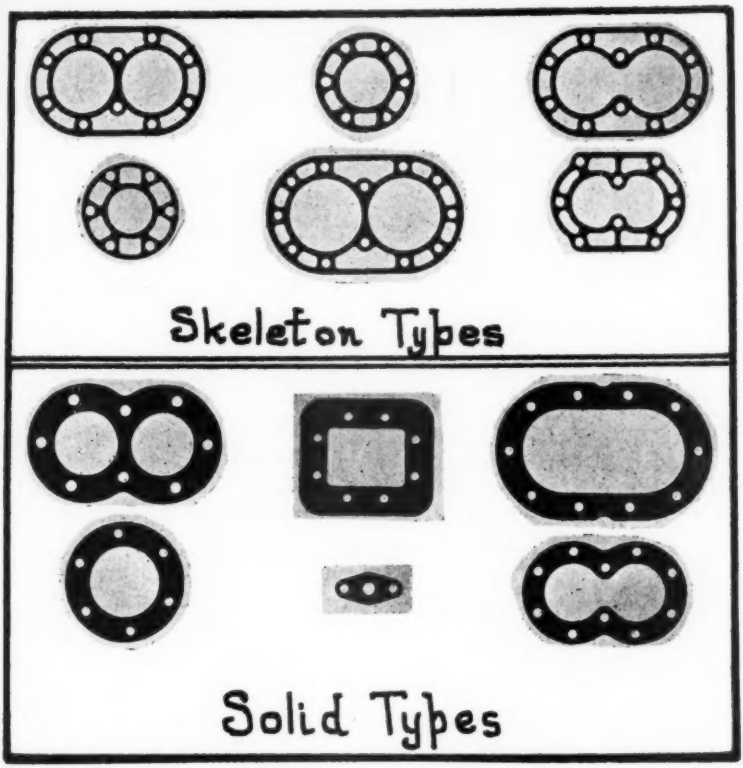
Bear in mind to first cut the inner hole. Then cut out the bolt holes. Last cut out the outer diameter. By leaving the extra stock around the gasket until the holes are cut it strengthens the gasket and prevents tears. This is especially necessary in cutting gaskets which have little stock between bolt holes and the edges of the gasket.

If desired, the outer diameter of the flange can be secured and marked on the sheet with the dividers after the inner diameter has been scribed.

Never place the gasket on a flange or gasket face and try to tap out the gasket with a hammer. The edge of the plate may be deformed and may result in difficulty in subsequently securing a tight joint.

A piece of iron wire, such as is used in forming the shelves in refrigerators, makes a splendid scriber. One end should be thinned down for several inches and provided with a sharp point. It will form a handy tool to reach into small bolt holes and to scribe lines close to the edge.

Some manufacturers make skeleton gaskets by removing some of the metal from the center of large bearing areas. This gives better seating. While this is an excellent thing for the factory the service man generally cuts a gasket without these relieved areas, leaving it plain and only pierced with the necessary bolt or water holes.



Lead gaskets generally seat better if the worker, after pulling down evenly on the studs or bolts, taps the flange with a hammer. This seats the gasket and the bolts can be pulled up a little more. After a gasket has been in use it may be found possible to pull down a little more on it, especially around the head of the compressor, where pounding results due to piston action.

Before putting a gasket in place make sure the flange surfaces are clean. Old gasket material can be scraped off by flattening a piece of ⅜ or ½ inch copper tubing and using it as a scraper. Do not use a knife, paint scraper, screwdriver or file, for where iron or steel is employed scratches or digs in the flange face are sure to result.

If old gasketing remains soften it with a little oil and carbon tetrachloride, letting it soak for a while if possible.

Sometimes it is necessary to use considerable force in separating gasketed parts and if excessive hammering is indulged in with an iron or steel hammer the edges of the flange face may be burred. These burrs will prevent the faces from being drawn tight enough to make the gasket effective and should be filed off. Burrs can be prevented by using a rawhide, rubber, lead or bronze hammer. Shop foremen should insist upon these soft hammers in all shop work.

Never use a screwdriver or chisel carelessly in prying apart flange faces as nicks and scratches may result. Be especially careful where grooved or corrugated seal surfaces are provided, as these are easy to spoil and difficult to return to a gas tight condition.

Most service men use too much force in returning and pulling down on bolts. As a result bolts are twisted off (often deep in the hole) or the threads are stripped. A

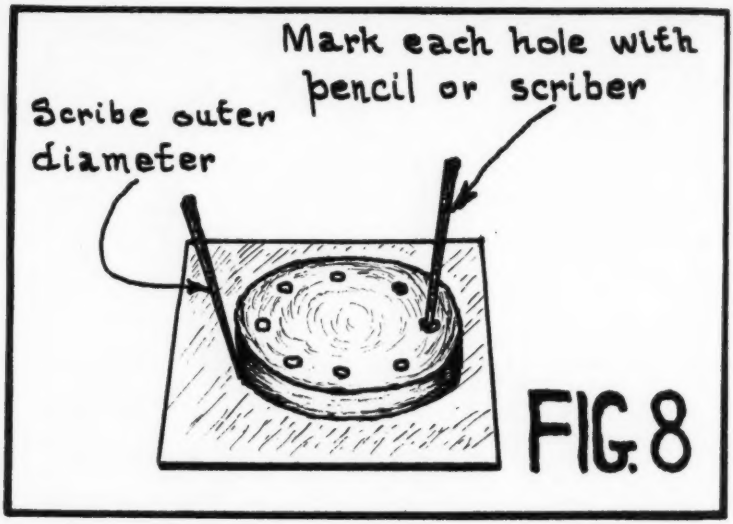


FIG. 8. SCRIBING OUTSIDE DIMENSION AND BOLT HOLES IN FLANGE PLATE.

flange which has had its bolts pulled down gradually and evenly all around will generally hold without excessive bolt tightening. Unevenly pulled down bolts will surely result in leaks and most probably in the destruction of bolts or threads.

Use socket wrenches or 12-point wrenches wherever possible, resorting to open ends only where it is impossible to use the former. Bolts or nuts will be left with clean edges where sockets or 12-point wrenches are used, but where open ends are employed the edges will be rounded and distorted and indicative of either poor or careless workmanship.

Some wrenches are rather long and offer great leverage. This is excellent in pulling down jobs, but the worker should "choke" the wrench or use one with a smaller handle in making up the bolts upon reassembly.

CORRECTIONS IN GASKET LISTINGS APPEARING IN FEBRUARY

The gaskets shown on page 24 and part of 25 of the February issue refer to Servel units, rather than Copeland units as listed at the top of the page. The error undoubtedly is obvious to the reader, inasmuch as this list is a continuation of the gaskets for Servel units starting on page 23.

SERVICE IDENTIFICATION

SO many times, the owner of a domestic or commercial system cannot remember the name of the service company who previously worked on the equipment, that it is advisable to have an identification tag giving this information for future calls.

An inconspicuous sticker can be conveniently placed on the door of the domestic box and a tag for commercial installations is always a handy reminder.

LEAK DETECTING

THE soap suds method of detecting methyl chloride leaks is not always satisfactory because the pressure of the refrigerant may be insufficient to show up small leaks and small amounts of the methyl chloride may dissolve in the solution.

The leak detectors now on the market are the most satisfactory way of detection and should be a part of the serviceman's tool kit. They have a number of uses.

The Question Box

Readers are invited to send their problems pertaining to the servicing of household refrigerators and small commercial refrigerating equipment as well as oil burners to "The Question Box." The following questions are answered by Mr. George H. Clark.

ICE-O-MATIC

QUESTION 187. *Of late, I have been working on a methyl chloride machine, namely, Ice-O-Matic, and since I am not familiar with methyl, I would greatly appreciate information on the following:*

1. General information on the characteristics of methyl with respect to causing any trouble?

2. What constitutes a very good, efficient methyl compressor? What is the minimum vacuum the compressor must pull against say 100 lbs. head to "get by"?

3. Will oil accumulate on top of the liquid causing logging?

4. Operating in a box normally, is it natural that the pump will pump oil between 3 lbs. and 10 inch vacuum, or is this condition a definite sign of excess oil?

1936 Household Ice-O-Matic

1. Single and Twin (Oil pressure system). Every so often, I run into a job where compressor is noisy. Operation and pressures normal. Noise seems to be in the head. By changing the flapper valve assembly, will remedy the noise sometimes, but not always. At times, the noise is eliminated by putting in an extra gasket between body and valve plate, but does not this condition lower compressor efficiency? Have you had any inquiries on this condition? If so, what is the cause and remedy? Is it a natural occurrence with the type of valve used?

2. Twin Job. A noise between a clicking and knock (best description I can give) occurs during entire on cycle. The noise occurs for only a few seconds, stops and then repeats itself at regular intervals. Noticed a slight increase or surge in oil pressure when noise is present. This has been a headache, and any help in remedying the condition would be greatly appreciated.

3. Why a loop in suction line?

4. What is purpose of valve between seal and oil reservoir in twin job?

General Information

1. Can a control on an a-c. job be put in a d-c. job? (Same size)?

2. Any other cause beside dirt or lack of oil causing seal squeak?

3. Machine squeaks at end of on cycle; also at the beginning of on cycle and continues for ½ the cycle and stops. Are these not seal squeaks? Cause?

4. Can a job be shy of gas and yet not have a warm liquid line?

5. What causes gurgling in the evaporator?

ANSWER: I will try to answer your questions as best I can in the order given.

1. The general troubles which may be encountered with the use of methyl chloride consist of mechanical freeze ups, which is the term applied to the condition wherein the moisture or water in the refrigerant freezes into ice at the expansion device restricting the flow of refrigerant so that the machine operates improperly as if the valve was plugged. Another trouble which has developed in methyl chlroide machines is corrosion of valve parts which has been due largely to the use of calcium chloride in a drier which was used for removing moisture from the refrigerant. Otherwise, I do not think of any particular characteristics which tend to cause trouble with methyl chloride. We do not have the stick-up trouble with methyl chloride anywhere near as frequently as with sulphur dioxide, when water gets into the system; and since methyl chloride for most uses is operated on a pressure greater

than atmospheric in all parts of the system, we have very little trouble with air leaking into the system and causing troubles. Most of the men who have become familiar with sulphur dioxide and have then operated on methyl chloride machines have stated that methyl chloride is harder to hold than sulphur dioxide. Of course, methyl chloride operates on higher pressures than sulphur dioxide and consequently if there are any leaks in the system, the methyl chloride will leak out in a shorter time. However, with the various types of leak detectors now in use, it is very easy to detect very small leaks with methyl chloride and consequently I believe there should be no difficulty from this standpoint.

2. A good methyl chloride compressor should draw 20 in. vacuum against a 100 lb. head pressure under normal conditions. In some cases a compressor which will draw only a 20-in. vacuum against a 100 lb. head pressure may be a very poor compressor while in other cases such a compressor operates very satisfactorily. I do not believe that this test gives a full indication of how good the compressor is. The real test is how much gas the compressor pumps under the normal operating pressures.

3. Oil does not accumulate on top of the liquid causing logging as in sulphur dioxide systems. The oil and methyl chloride go into solution in almost any proportion. We do have trouble, however, in float valve evaporators on multiple systems where oil and refrigerant enter the evaporator in solution and the refrigerant distills out of the solution and passes back to the compressor as a vapor, leaving the oil in the evaporator. This only happens occasionally as in general the refrigerant which contains oil will foam considerably as it boils and this foam is largely the oil in the refrigerant; or possibly I should say the refrigerant bubbles in the oil so that the oil carries back through the suction line into the compressor.

4. The thing that causes oil slugging is not so much the pressure that occurs in the crank case as the rate at which the pressure drops. If the pressure drops rapidly, the oil in the crank case tends to foam and the foam carries through the compressor hammering on the head and gives us the slugging condition. This may indicate excessive oil if everything else is normal. This condition will also occur when methyl chloride liquid gets into the crank case or when the suction pressure during an off period has been quite high so as to force a lot of methyl chloride gas into solution with the oil. It will be especially pronounced in case there is anything wrong in the system which causes the pressure in the crank case to be reduced exceptionally fast as the compressor starts.

1936 Household Ice-O-Matic

1. The noise which you describe is quite apt to be due to the way the gas passes through the discharge valve in the compressor and the way the oil passes through with the vapor. In some cases the noise may be stopped by adding oil and in some cases the valve itself may have to be changed. If the piston strikes the head of the compressor, as is indicated by the fact that an extra gasket between body and valve plates stops the knock, it is an indication that the clearance is too small and the extra gasket should not increase the clearance enough to decrease the efficiency appreciably. I have noticed this same type of noise occurs with a good many compressors and do not believe that it is confined to the Williams machine.

2. With respect to the twin cylinder compressor, I believe the above discussion applies to this case.

3. The loop in the suction line is probably supplied to allow a certain amount of elasticity between the condensing unit and the stationary tube from the evaporator.

4. The valve between seal and oil reservoir is undoubtedly for use in servicing the compressor.

General Information

1. An a-c. control can ordinarily be used on a d-c. job but is apt to have a short life as with direct current on an inductive load when the circuit is opened, a high voltage is built up tending to keep the current flowing, and this causes an arc across the switch contacts which tends to burn out the contacts in a short time. If a relay is used, the holding coil must be adapted to the particular voltage and frequency of current used.

2. A seal squeak may not necessarily be caused by dirt and lack of oil. It may be caused by some characteristic of the metal surface condition. In general this can be eliminated by relapping and reassembling.

3. The squeaks which you describe may be either seal squeaks, squeaks in the motor brushes, or possibly belt squeaks. Investigate all possibilities.

4. A machine can be low on refrigerant and still not have a warm liquid line.

5. The gurgling in the evaporator may be caused by the normal boiling or by refrigerant bubbling through oil in the evaporator which may be partially oil bound.

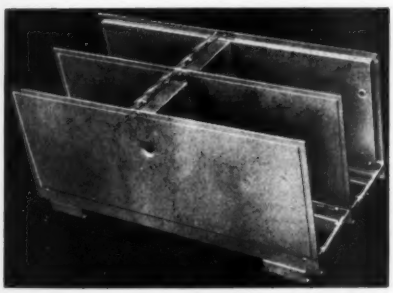
NEW MECHANICAL DEVICES

Service Tools and Special Equipment

Under this heading there will be published illustrated descriptions of new or improved service tools and equipment for the Service Engineer. Information contained in this department is furnished by the manufacturer of the article described and is not to be construed as the opinion of the Editor.

KOLD-HOLD MFG. CO.'S NEW ICE CREAM CABINET CONVERSION UNITS

THE Kold-Hold Manufacturing Company of Lansing, Mich., manufacturers of the very popular Kold-Hold system of truck refrigeration, have recently offered to the ice cream trade an extensive line of ice



KOLD-HOLD ICE CREAM CABINET UNIT.

cream cabinet conversion units. These are described by the manufacturers as being easily and quickly adjustable to fit standard cabinets—exceptionally efficient in maintaining the desired temperatures—very economical in operation—and providing speedy pull-down. Construction is entirely of rust-proof steel. Controls used in the cabinet's original refrigerating system can be utilized in operating the conversion units.

A complete description of the new Kold-Hold Conversion Units is contained in a circular known as Kold-Hold Bulletin No. 109, copy of which may be had by addressing the company.

NEW IMPERIAL SEALED STRAINERS AND DEHYDRATORS

A SEALED strainer with 120 mesh screen plus a closely woven asbestos cloth sack and a new small size sealed strainer are recent announcements of the Imperial Brass Mfg. Co., 1200 W. Harrison Street, Chicago, Ill.

Both strainers are made from two-inch o.d. copper tube and the No. 249C strainer with the asbestos sack has 17¾ square inches of 120 mesh screen and a shell length of 5½ inches with ¼ inch and ⅜ inch o.d. S. A. E. and ⅜ inch female iron pipe size connections. The asbestos cloth gives additional protection against exceptionally fine particles.

FIG. 1. NEW STRAINER HAS ASBESTOS SACK INSIDE 120 MESH SCREEN.

The 248C strainer is built in 2½ inch shell with 6 square inches of 120 mesh screen and a 5½ inch shell with 17¾ square inches of screen. Both sizes have the same connections as the No. 249C strainer. This small strainer fills the need for an inexpensive strainer for removing scale, compressor chips or dirt in the oil.

Imperial Brass Brings Out Two New Dehydrators

A brass shell dehydrator with drier contained in a refill cartridge and a large steel shell dehydrator are also recent additions to the dehydrator line of the Imperial Brass Mfg. Co.

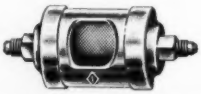


FIG. 2. NEW IMPERIAL SMALL SIZE SEALED STRAINER.

The dehydrator with the refill cartridge is built in two shell lengths of 6 and 12 inches with one cartridge in the 6 inch shell and two in the 12 inch size, for ¼ inch, ⅜ inch and ½ inch o.d. S. A. E. tubing and ⅜ inch female iron pipe thread connections. The shell and flanged end are bolted to allow for

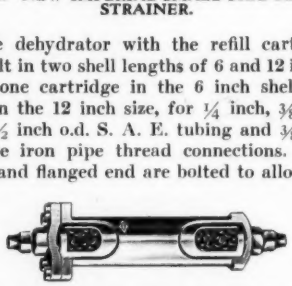


FIG. 3. IMPERIAL CARTRIDGE REFILL TYPE OF DEHYDRATOR.

quick change and when this end is put on the inlet side, the dirt and scale can be removed when replacement is made. Cartridges are furnished containing activated alumina, calcium chloride, or calcium oxide. The cartridge is made of brass with screen and felt at each end. The refill cartridges are inexpensive and the added convenience and increased servicing speed are expected to make this type of dehydrator an important addition to the Imperial line.

FIG. 14. NEW IMPERIAL STEEL DEHYDRATOR.

The large steel dehydrator is for refrigeration and air conditioning work. It has a steel shell 4 inches in diameter and is furnished in 18, 24 and 36 inch lengths. All ends have 1½ inch female iron pipe threads and screens and steel wool are included.

Imperial's 1937 Line Includes Many New Items

New valves, dehydrators, strainers and fittings are among the many new items included in the 1937 Imperial line of refrigeration and air conditioning equipment, it is disclosed in an announcement just issued by this company.

Outstanding among the items is the new line of refillable dehydrators with demountable flange described above.

Other new dehydrators include sealed end and dispersion tubes types, a small low priced one, and also a line of large steel shell dehydrators 4 inches in diameter.

New valves include a pressure relief and emergency valve, evaporator liquid valve, two types of small service drum valves, and an evaporator suction valve. The company's line of "Sylpak" valves has been redesigned so that the bonnet is now shorter and the valve now fits a four inch conduit box.

Two high-side floats are included in the line, one being for use with sulphur dioxide, "Freon" and methyl chloride, while the other is for use with sulphur dioxide only.

A large number of new sizes and items have been added to this company's line of fittings, and all tees and elbows have been redesigned, and in the future will be furnished with flats for wrench hold.

S S S

THERMAL SERVICE NOW VIRGINIA DISTRIBUTOR

THERMAL Service Company, Inc., 2490-94 University Avenue, Saint Paul, Minnesota, has been appointed a distributor for the Virginia Smelting Company's Extra Dry Esotoo and V-Meth-L. Thermal Service Company is well and favorably known to the trade in the Saint Paul area and is anticipating a greatly increased volume of business for the coming season.

S S S

COPELAND SALES PLANS

COPELAND'S new campaign of advertising in national magazines and local newspapers will make its appearance during March, it was announced recently by J. D. McLeod, general sales manager of the Copeland Refrigeration Corporation.

"Our activities in expanding our distributor and dealer organization during the past two months have been highly gratifying," said Mr. McLeod. "Our trade publication advertising, plus the work done by our force of district managers, has resulted in many hundreds of inquiries from distributors and

dealers and from them we are recruiting many additions to our ranks.

"With open points rapidly being signed up, we are now ready for advertising on a national scale."

In addition to a list of newspapers covering most of the principal cities of the United States, Copeland's advertising will appear regularly in the Saturday Evening Post and Time.

The new series of advertisements strikes an entirely new note in refrigerator advertising. The central theme of the series points out that "you can make no mistake no matter which of the better electric refrigerators you buy, for *all* of them have *all* of the worthwhile features." But, it is emphasized, there is one great point of difference, the refrigerating unit itself, and on this score Copeland lays claim to superiority.

REFRIGERATION MAINTENANCE SPECIALIZES IN REBUILDING HERMETICS

ONE of the oldest and largest organizations specializing in the repairing of hermetically-sealed units is the Refrigeration Maintenance Corp., 865 E. Illinois St., Chicago. This organization has been engaged in the rebuilding of these units for the past seven years, and during that time thousands have been rebuilt for servicing organizations throughout the country.

A special department, equipped with the necessary tools for complete rebuilding of all types of hermetic units has, during this period, developed equipment that provides for rapid service and efficient workmanship. The equipment consists of both mechanical equipment for testing purposes, and complete electrical test equipment.

The company has made a specialty of repairing hermetic units for other service companies who may not be equipped to rebuild this type of unit. This department handles General Electric, Majestic, Servel and Westinghouse, and many of the types can be immediately replaced. The units all carry a one year unconditional guarantee.

NEW MANAGER FOR ALTER CLEVELAND BRANCH

MR. Henry Spivak, formerly manager of the south side Chicago branch of the Harry Alter Co., has assumed the managership of the Cleveland store, replacing Mr. K. P. Wall, resigned.

The Cleveland store is serving this area with practically a complete line of Alter refrigeration parts as listed in their catalog. Mr. Spivak is a member of Chicago Chapter, R.S.E.S.

Mr. Steve Majeski, formerly counter man at the main Harry Alter Chicago store, has been given the post at the south side branch.

MINNEAPOLIS-HONEYWELL ACQUIRES NATIONAL REGULATOR CO.

AN agreement for the acquisition of the complete line of pneumatic controls manufactured by the National Regulator Co. of Chicago, has been entered into between that company and Minneapolis-Honeywell Regulator Company. Minneapolis-Honeywell is the oldest and largest manufacturer of control equipment, being established in 1885, while the National Regulator Company was formed thirty-five years ago. As a result of this acquisition by Minneapolis-Honeywell, the heating, ventilating and air conditioning industry and the collaborating professions will have available from one reliable source a full range of both pneumatic and electric controls and control systems.

ALTER'S "DEPENDABOOK" NO. 117 JUST PUBLISHED

THE first 1937 edition of the Harry Alter Company's parts catalog is just being mailed, and this 108-page 7½" x 10¼" catalog is a complete revision of merchandise and prices over the previous catalog.

The new catalog contains 12 more pages than formerly, and among other features, lists complete stocks of nationally known products such as: Imperial Brass, Detroit Lubricator, Penn Electric Switch, Ranco, Cutler-Hammer, Square D, Zenith, Chieftain, Dayton, Prest-o-Lite, etc.

The catalog has a complete revision of prices and listings of Fedders valves, evaporators and coils, and a new line of Imperial refrigerator accessories and fittings. Added to these lines are included several pages devoted to All Kold counter display cases, walk-in coolers and refrigerators, as well as a complete listing of Texaco Capella oils.

Naturally such important items as servicemen's tools, supplies, trays, gasketing materials, accessories, refrigerant gases,

tubing and fittings find an important place in the Alter catalog.

A new idea that is fully explained in this "Dependabook" is the serviceman's catalog "Expert Refrigeration Service," which has been developed to be a retail catalog and show only retail prices. It is intended that this catalog be distributed by the service company to their customers, and sufficient reader interest has been included so that it will be retained for ready reference. It provides an opportunity for the serviceman to sell his service, securing a fair price for his material and labor. Several pages are devoted to accessories, such as: ice cube trays, defrosting trays, refrigerator dishes and deodorizers. The Harry Alter Company name does not appear in any part of the catalog, and across the bottom of the front cover is provided space for the service company's name, address and telephone number, which designates the catalog as the service company's own individual illustrated catalog of refrigeration service. This catalog is being disposed of to service companies at most economical prices.

Irving Alter, manager of the Refrigeration Department, invites any service company which is not already on the mailing list, to send for this catalog. It is essentially necessary in requesting a catalog that the service company or individual identify himself, as part of the Alter guarantee is to sell only to established refrigeration dealers and service companies.

S S S

REX REFRIGERATION SERVICE ACQUIRES U. S. HERMETIC EQUIPMENT

ARNOLD L. Schroeder, vice-president of Rex Refrigeration Service, Inc., 2226 S. State St., Chicago, has recently announced the acquisition, from the General Household Utilities Co., of all U. S. Hermetic refrigerators, parts, equipment, units, cabinets, tools, assembling, repairing and refrigerator building equipment from the former plant where U. S. Hermetics were manufactured in Marion, Ind.

In addition, this company has secured the complete servicing department and unit under warranty. All of the equipment of the Marion plant has been moved to Chicago, which will augment the Rex facilities for the servicing of refrigeration equipment.

Rex Refrigeration Service, Inc., recently moved to its new servicing plant at 2226 S. State St., as a result of outgrowing its former quarters at 446-8 East 79th St., where this company has been established for several years.

Rex Refrigeration Service Inc. has been actively engaged in the refrigeration servicing and rebuilding business for the past eight years, and their new quarters containing about 8,500 square feet, will house much special equipment for the rebuilding and servicing of hermetically-sealed refrigerating units.

S S S

PEERLESS TO MANUFACTURE COMMERCIAL COOLING COILS FOR G. E.

HAROLD Hulett, Ass't Sales Manager of the commercial refrigeration department of the General Electric Company has announced a working agreement with Peerless of America, formerly the Peerless Ice Machine Company, whereby the latter will manufacture all commercial refrigeration coils, with the exception of forced convection and air conditioning low sides, for General Electric.

GENERAL ELECTRIC SIGNS FOR PEERLESS COILS.

Left to right: M. W. Knight, Gen'l Sales Mgr. Peerless of America, Inc.; H. T. Hulett, Ass't Commercial Mgr. General Electric, and W. M. Timmerman, Mgr. Commercial Engineering Div. General Electric.

According to Mr. Hulett a number of advantages will accrue from the new arrangement. The three Peerless factories in Chicago, New York, and Los Angeles will be able to give quicker delivery than could a single, centrally located source of supply, and at the same time effect considerable savings to the General Electric dealers and distributors in the cost of transportation.

Inasmuch as Peerless are exclusively coil manufacturers, shipments can be made

within 24 hours of receipt of order. This will eliminate the necessity for General Electric as well as its dealers and distributors of carrying large stocks of odd size coils, releasing working capital invested in a slow turning inventory, and eliminating the need for excess warehousing facilities.

In selecting Peerless coils the factors considered which led to the selection included the patented "Rifled" tubing, so constructed that the refrigerant in passing through the tube is thrown against the entire tubing wall, greatly increasing heat transfer: all finned courses have a one inch space between them, allowing better air circulation through the coil and delivering a large volume of more evenly cooled air; fins are automatically "wedge locked" to tubing, insuring absolute metal to metal contact; each finned course is edge-locked to give greater rigidity and evenness to the coil.

General Electric engineers are now working on the engineering data and specification sheets which will be inserted in the specifications manual. This information will be available soon to dealers, distributors, and other interested parties.

S S S

MINNEAPOLIS-HONEYWELL SELLS AIR CONDITIONING ON BEHALF OF INDUSTRY

FINDING considerable confusion in the minds of the public in regard to the meaning of the term Air Conditioning, Minneapolis-Honeywell has devoted its entire Spring advertising campaign towards selling air conditioning to the public on behalf of the Industry.

As a result of a number of questionnaires throughout the industry and among consumers, it seems to be quite clear that the majority regard air conditioning as a synonym for cooling, in summer, or humidifying in winter. The majority are not yet conscious that air conditioning embodies cooling, circulating, cleansing, and de-humidifying in warm months, and heating, circulating, cleansing and humidifying in cold months.

Picture shows one of a series of advertisements to appear in national magazines, with John Pauling, Vice-President, pointing out the Air Conditioning signature to George Kingsland, also Vice-President, while George B. Benton (right), Director of Advertising, and Addison Lewis, Addison Lewis & Associates, look on.

Magazines such as *"Time," "Life," "House Beautiful," "House and Garden," "American Home," "Business Week" and "Nation's Business"* will be used in the Spring, to be followed by similar effort, emphasizing automatic heating and air conditioning in the late summer and fall months. In addition to national magazines, newspaper space will be used in the majority of the larger centers.

S S S

OIL HEAT REQUIRES PROPER INSTALLATION AND SERVICE

TO prospective buyers of oil burners for home heating, forced to choose from the 200 or more makes on the market, the Bureau of Agricultural Engineering gives this general advice in a new circular, "Oil Burners for Home Heating":

"Even a first-grade burner improperly installed, or for which service is not readily available, will be unsatisfactory. All burners require some servicing. A burner installed by inexperienced workmen, even with the aid of explicit printed instructions, is likely to prove unsatisfactory.

"It is well to keep in mind experiences of other purchasers and seek not the best burner but rather one that is handled by a reliable organization which employs capable service men. * * *

In this connection the Bureau notes that it "has not yet been able to find any definite relation between price and quality" in buying oil burners.

The publication Circular 406, for sale by the Superintendent of Documents, Washington, D. C., at 5 cents a copy, seeks to answer the thousands of requests for information on oil burners which the Departmen receives. It is illustrated, and discusses fuel grades, types of burners, methods of ignition, the adaptation of present heating plants to oil burners, etc.

The REFRIGERATION SERVICE ENGINEER

A Monthly Illustrated Journal, Devoted to the Interests of the Engineer Servicing Refrigeration Units, Oil Burners and other Household Equipment.

Vol. 5 March, 1937 No. 3

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Official Organ
REFRIGERATION SERVICE ENGINEERS' SOCIETY

READY

AS we prepare for a season that promises to make refrigeration history from the standpoint of activity for the service engineer, let's make a frank check-up of our business house and see that it is in order.

In building a business for future stability (and that means attracting new customers as well as retaining the old) the most valuable asset a business can possess, regardless of the size of its operation, is *customer confidence.* Confidence is the result of honesty, ability and efficiency. Without it no business can long survive. Remember, a lost customer requires two new ones to make an increase.

Refrigeration is a service business. Your customer judges you upon your honest desire to serve promptly and efficiently. Be honest. Don't disappoint your customer with promises you know cannot be kept. Make sure that your entire organization reflects your business ability. Their appearance is important—first impressions are lasting impressions and you want to be certain that this first impression will be right.

Another important business attribute that is frequently overlooked, is the maintenance of proper credit relations with your sources of supply. By the same token that you expect your customers to honor credit extensions, so should the conduct of your business be planned to meet invoice dates promptly. Credit is a courtesy extended to you, based upon confidence in you to meet your obligations. Value your credit relationships. When it becomes necessary to request an extension of time, be honest and do not make extravagant promises regarding future payments.

These few facts are so elementary that they seem obvious, yet how many times are the obvious things overlooked.

S S S

NEW SERIES OF ARTICLES

STARTING in this issue is the first of a series of articles on Air Conditioning. The purpose of this series is to acquaint refrigeration service engineers with the fundamental considerations of air conditioning. It is to be expected that service men will be called upon to install and service such installations and should be in a position to analyze service complaints to ascertain if the fault is the refrigerating equipment or other design factors.

S S S

AIR CONDITIONING

(Continued from Page 34)

proving business conditions, it is believed, will also materially stimulate the demand for water and beverage coolers, especially with improved cooler models available this year.

Western delegates at the distributor conferences heard details of the recent merger of Kelvinator Corporation and The Nash Motors Company, to form the new Nash-Kelvinator Corporation, outlined against the history of Kelvinator Corporation and the organization and growth of its Commercial Division.

Accompanying Commercial Division Manager Harlan to the West Coast were A. H. Reinach, Sales Manager of the Standard Commercial and Liquid Cooling Department; L. G. Estep, Assistant Sales Manager in charge of Residential Air Conditioning; H. M. McGaughey, Assistant Sales Manager of Commercial Air Conditioning; and A. U. Salomon, Specialist on Beverage Coolers.

Eastern and Mid-western cities that will participate in the Kelvinator Commercial Distributors Regional Conference plan this spring, which supplants the single convention formerly held annually in Detroit, are Boston, New York, Baltimore, Cincinnati, Atlanta, St. Louis and Chicago.

REFRIGERATION SERVICE ENGINEERS' SOCIETY

Official Announcements of the activities of the National Society and Local Chapters appear in this department as well as articles pertaining to the educational work of the Society.

THE OBJECTS OF THE SOCIETY

To further the education and elevation of its members in the art and science of refrigeration engineering; for the reading and discussion of appropriate papers and lectures; the preparation and distribution among the membership of useful and practical information concerning the design, construction, operation and servicing of refrigerating machinery.

ASSOCIATION HEADQUARTERS: 433-435 North Waller Ave., CHICAGO, ILL.

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INDIANAPOLIS CHAPTER NO. I, INDIANAPOLIS, IND.: Meets on the 2nd and 4th Tuesday of each month on the 14th floor of the Lincoln Hotel. President, Wm. L. Drake; Secretary, E. R. Claus, 815 S. Delaware St., Indianapolis, Ind.

4th Annual Convention
Stevens Hotel, CHICAGO
November 3, 4 and 5

KANSAS CITY CHAPTER NO. I, KANSAS CITY, MO.: Meets on 2nd and 4th Tuesday of each month at the Commonwealth Hotel. President, H. L. Green; Secretary, R. E. Kingsolver, 3830 Woodland, Kansas City, Mo.

MEMPHIS CHAPTER NO. I, MEMPHIS, TENN.: Meets every Wednesday at 943 Madison Avenue. President, R. F. Weidlein; Secretary, W. C. Easley, 2590 Yale, Memphis, Tenn.

MILWAUKEE CHAPTER NO. I, MILWAUKEE, WIS.: Meets on the 1st and 3rd Tuesdays of each month at the Metropolitan Hall, 541 W. Clark St. President, J. J. Geering; Secretary, Wray Heath, 2565 N. 67th St., Milwaukee, Wis.

MISSISSIPPI VALLEY CHAPTER NO. I, DAVENPORT, IOWA: President, J. L. Fish; Secretary, E. L. Bengston, 118 E. Front St., Davenport, Iowa.

MONTGOMERY CHAPTER NO. I, MONTGOMERY, ALABAMA: Temporary President, Bruce G. Allen; Temporary Secretary, Carl C. Collins, 222 Dexter Ave., Montgomery, Ala.

NEW YORK CHAPTER NO. I, NEW YORK, N. Y.: President, Grover C. Busse; Secretary, Harold Herkimer, 1819 Broadway, New York, N. Y.

NIAGARA FRONTIER CHAPTER NO. I, BUFFALO, N. Y.: Meets on the 2nd and 4th Wednesdays of each month at Langs Hall, East North and Fox Streets. President, D. B. Schuster; Secretary, W. S. Powell, 248 Springville Ave., Eggertsville, N. Y.; Recording Secretary, F. H. Walker, 2271 Elmwood Ave., Buffalo, N. Y.

ONTARIO MAPLE LEAF CHAPTER NO. I, TORONTO, ONT., CANADA: Meets on the 2nd and 4th Fridays of each month at the Carls-Rite Hotel, Toronto. President, A. E. Doan; Secretary, H. F. Nye, 80 Ontario Street, Toronto, Ont., Canada.

PITTSBURGH CHAPTER NO. I, PITTSBURGH, PA.: Meets on the 2nd Monday of each month in the Corporation Room of the Commonwealth Building. President, John Kirch; Secretary, F. V. Goltz, 1518 Davis Ave., Pittsburgh, Pa.

ROCKFORD CHAPTER NO. I, ROCKFORD, ILL.: Meets on the 1st and 3rd Wednesday of each month at the Nelson Hotel. President, George E. Moon; Secretary, Walter W. Larson, 1120 10th Ave., Rockford, Ill.

ST. JOSEPH CHAPTER NO. I, ST. JOSEPH, MO.: Temporary President, E. J. Storm; Temporary Secretary, Peter Robbins, 1023 Edward, St. Joseph, Mo.

ST. LOUIS CHAPTER NO. I, ST. LOUIS, MO.: Meets on the 2nd and 4th Thursdays of each month at the German House, 2345 Lafayette St. President, E. Gyrax; Secretary-Treasurer, E. A. Plesskott, 2145 67th St., St. Louis, Mo.

TWIN CITIES CHAPTER NO. I, ST. PAUL, MINN.: Meets on the 2nd Tuesday of each month at the Midway Y. M. C. A., at 1977 University Ave., St. Paul. President, A. E. Johansen; Secretary, J. Samways, 3015 Clinton Ave., So., Minneapolis, Minn.

YOUNGSTOWN CHAPTER NO. I, YOUNGSTOWN, OHIO: Meets on the 1st and 3rd Monday of each month at the Central Y. M. C. A. President, Martin Bokesch, Sr.; Secretary, M. W. Bokesch, Jr., R. F. D. No. 5, Youngstown, Ohio.

THE PRESIDENT'S MESSAGE

TO the newly elected officers of local chapters:

First of all I want to congratulate you on your election as officers of your chapters for 1937.

You have been extended a vote of confidence by the members of your chapter, and I know that you are all anxious to show yourselves worthy of this confidence and to make your chapter the outstanding chapter in the organization.

You may be assured of the wholehearted support of the National Office, and I urge you to put your problems before the National Board and take advantage of the help you can receive from them.

Call on each of the National Officers to help you along and particularly the National Officer who is located near your city; he will be glad to assist you in your progress.

I suggest that you immediately outline a program for the coming year. Have a definite plan to work by. Get a general idea from your members of the subjects they would like to hear, and then contact the speaker you believe is most qualified to speak on this subject; date him up for some future meeting, and keep on until your program is filled.

A list of subjects to be taken up during the year is also a valuable aid in getting new members. Show them what you are doing and they will join more readily.

How many chapters are there in your state?

Make it part of your program to form a new chapter in the nearest large community. This will make your chapter better known and will bring you recognition at the National Convention. It will also help increase your membership.

You may get all the literature and help necessary from the National Secretary, Mr. H. T. McDermott, Chicago, or the Chairman of the National Membership Committee, Mr. C. O. McCauley, 405 Penn Ave., Pittsburgh, Pa. Contact both of these men and tell them which city you would like to work on and they will suggest the best way to start the work.

Invite a joint meeting between your chapter and the chapter nearest your city. You will derive much pleasure from such a meeting and your members will make social and business contacts which they will enjoy.

While on the subject of social affairs, I believe you should start planning for a stag to be held in April. Have an entertaining program and sell tickets to members and their friends.

Have a picnic in July or August for the members and their friends, and a few prizes for the various games will make everyone more enthusiastic.

Take particular pains with the banquet which you should have in the fall. This is the most important of all your social affairs. I would suggest that you plan having this banquet in October. It will promote a better feeling among the members and their wives and will also bring more members to your chapter and will finally be instrumental in bringing more of your members to the National Convention next November 3, 4 and 5.

Write Mr. Herman Goldberg, 5101 West Madison Street, Chicago. He is chairman of the National Entertainment Committee and will be glad to correspond with you on the best way to run your social affairs, and can give you much valuable information.

I sincerely hope that 1937 will be a banner year for your chapter and that you will be successful in your new office.

I again want to assure you that the National Officers will be very pleased to work with you if you will only call on them.

With kindest regards to the members of your chapter and to yourself, I am

Cordially yours,

PAUL JACOBSEN, *President.*

GREETINGS FROM THE MEMPHIS AUXILIARY

By **MARION UETZ**
National Chairlady

THE ladies of the Memphis Auxiliary say "Howdy" to the readers of the R. S.E. magazine, having fully recovered from the effects of the Convention.

We have been quite busy with our election and installation of officers for the coming year which was held jointly with the men December 28th, 1936. The following ladies who were elected to office the early part of December were installed on this date, after which a dinner dance was enjoyed by all present.

Officers for the Year 1937

Mrs. Margaret Bridges, president.
Mrs. Velma Evans, vice-president.
Mrs. Alice Geiser, secretary.
Mrs. Lois Gibson, treasurer.

Our first meeting was held at the home of Mrs. Marion Uetz, National Chairlady

of the Auxiliary, and the various committees for the year were appointed by the president. The second and fourth Tuesdays in each month were selected as the regular meeting days for the Auxiliary; the first one in each month to be held at the hall of the R.S.E.S. being a business meeting, and the other meetings to be of a social nature, will be held at the homes of members of the Auxiliary.

Dues were discussed and several suggestions were made as to the amount but no definite action was taken at this time regarding this matter and it was held over until the February meeting. It was decided at this meeting that a freewill offering would be taken at every meeting and put into a fund to be used in cases of sickness, etc.

A box supper planned for the men February 3rd went over in a big way—and to prove that "the way to a man's heart is through his stomach," they voted at their last meeting to give the ladies one Wednesday night a month and we are planning many happy Wednesday evenings for the future.

With the money derived from the sale of the box lunches to the men, we bought silver (the ten cent kind), the dishes having been donated by the ladies and we are now in a position to entertain the men royally.

At our February meeting we had a very nice attendance in spite of the bad weather and sickness among the members. Reports were given and a motion was made, voted on and carried that the annual dues be $2.00, and as we have twenty members on roll at this time we hope to have a substantial amount to turn over to the National Auxiliary when formed in November of this year, at our next convention in Chicago. Here's hoping to see "you all" there—more next time.

Here's to the Ladies Auxiliary,
The first one far and near.
So let us all work together,
For a Happy and Prosperous New Year.
(Toast submitted by Mrs. R. J. Rick.)

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OHIO CHAPTERS APPLY FOR STATE CHARTER

THROUGH the initiative of Cleveland Chapter and the cooperation of Youngstown and Akron, the first state association of our National Society will be the Ohio State.

A petition for the state charter has been forwarded to the national headquarters and has been favorably acted upon.

Plans for the first meeting of the State Association are being made and the date will be established in the near future. It was decided that the secretary of each of the three chapters should act as a committee to arrange for the meeting, and Mr. K. P. Wall, secretary of the Cleveland Chapter, was appointed chairman.

* * *

COLUMBUS CHAPTER UNDER FORMATION

AS this issue goes to press, we are pleased to record the meeting of service men held in Columbus on Thursday, February 25th, at the offices of the Hughes Peters Electric Corporation, refrigeration jobbers.

Past-president James H. Downs of the National Society, Mr. Otto Sippel, president of Cleveland Chapter, and Mr. K. P. Wall, secretary of Cleveland Chapter were present to address the gathering of service men and to outline the purposes and objects of the National Society.

A further report of the activities of this newest organization will be carried in the April issue of THE REFRIGERATION SERVICE ENGINEER. In order to proceed with the formation of the chapter, Messrs. R. E. McCann, L. E. Mack and C. C. Callahan of Columbus were appointed as a committee to complete details for the formation of the chapter and to issue a call for the second meeting and the selection of officers.

* * *

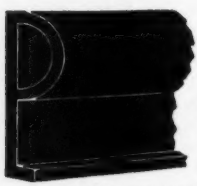
MONTGOMERY, ALABAMA, APPLIES FOR CHARTER

ANOTHER local chapter of the R.S.E.S. has been added to the National Society's roster. This time our newest chapter comes from the South.

On January 19th a group of service men held an informal meeting, and action was taken to apply for a charter from the National Society. Sixteen members indicated their desire to affiliate as charter members, and the petition together with the formal application of each member was forwarded to the National Office.

To serve the chapter during its formative

DOOR GASKETS



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period, the following temporary officers were elected: Bruce G. Allen, *president;* Paul F. Renaud, *1st vice-president;* Carl C. Collins, *secretary-treasurer.*

The members applying for charter are as follows:

B. G. Allen	H. H. Rawlinson
G. H. Britt	J. H. Reese
F. D. Buce	M. T. Reese
C. C. Collins	P. F. Renaud
S. B. Goodwin, Jr.	P. F. Renaud, III
W. C. Goodwin	W. M. Sims
M. B. Howard	W. I. Thompson
P. S. Powell	W. L. Williams

MISSISSIPPI VALLEY CHAPTER RECEIVES ITS CHARTER

AT a dinner meeting attended by approximately fifty members and guests, Mississippi Valley Chapter set aside February 12th as charter night. The dinner was held at the Hotel Davenport, Davenport, Iowa, and after the inner-man had been satisfied, Temporary President H. J. McChesney called the meeting to order.

National Secretary H. T. McDermott was introduced, and proceeded with the presentation of the charter as well as the obligation of the members.

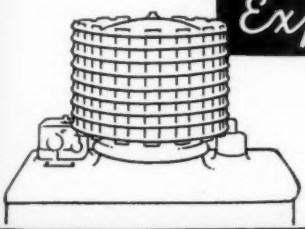
The meeting then proceeded with the formal election of permanent officers to serve for the calendar year. Mr. J. L. Fish was elected as president, and Mr. E. L. Bengston as secretary.

The Galesburg (Illinois) group extended a cordial invitation for the meeting of February 26th. This meeting was held in the social rooms of the Illinois Power and Light Company, and the speaker of the evening was Mr. Dan D. Wile of the Detroit Lubricator Company. As usual, Mr. Wile's address was enthusiastically received. Some thirty-three members attended this meeting.

The charter members of Mississippi Valley Chapter are:

Harold Baker	A. I. Rittenhouse
Otto Balke	A. H. Russ
E. L. Bengston	J. H. Sackey
O. W. Carlson	T. T. Schleuter
W. T. Cawiezell	W. A. Scott
Angelo Conti	V. T. Spicer
H. DeFoor	R. F. Spiker
E. M. Dick	G. M. Stebbins
W. F. Dunk	R. E. Stormer
J. L. Fish	G. H. Swails
E. J. Ford	Meryl Swanson
E. F. Fredericks	C. A. Teagarden
E. A. Garwood	Fred Tindall
C. L. Hartman	James Ven Horst
Milton Heidt	John H. Ven Horst
C. D. Kaufman	I. W. Waage
R. A. Klavine	F. A. Weatherly
H. J. McChesney	L. R. White
A. B. Munchrath	H. A. Willetts
L. C. Nelson	R. H. Williams
C. F. Pettersson	F. H. Wolcott

Dale Yaap



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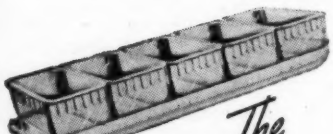

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It is made in two sizes, the smaller size four jars, ten inches in length—and the larger size five jars, twelve inches in length. You miss a great opportunity if you don't get immediate information on this, get your stock in, and get your share of the business. Address

Scurlock Kontanerette Corporation
1477 Merchandise Mart, Chicago, Illinois

Frigidaire Div. of General Motors Sales Corp. Acts as Host to Niagara Frontier Chapter

AT the meeting held February 10, 1937, Mr. Donald Schuster, President of the Chapter, announced to the members and their friends that all regular matters of business would be laid on the table pending a motion to that effect and that the regular meeting would be adjourned.

Following the adjournment of the regular meeting, the meeting was then turned over to Mr. George Wilson, acting educational director under the chairmanship of Mr. Jos. Askin, Chief Engineer of Fedders Manufacturing Company. Mr. Wilson pointed out for the benefit of the new members and guests, the purpose and aims of the Society and particularly the educational advantages. Following this brief talk he introduced Mr. H. S. de LaGrange of the Frigidaire Division of the General Motors Sales Corporation.

After greeting the officers, members, guests and other manufacturers' representatives who were present, Mr. de LaGrange pointed out the mutual interest of the manufacturer and the serviceman in the rendering of the type of service that satisfied the customer. Having joined the R.S.E.S. as an associate member in Philadelphia, he was conversant with the purpose and aims of the Society and said it gave him pleasure to be in position where he was able to cooperate with the Society and particularly with the Educational Committee. Mr. de LaGrange then introduced Mr. Paul Garthe of the Technical Division, Frigidaire Division of the General Motors at Dayton, Ohio.

After acknowledging the greeting accorded him, Mr. Garthe outlined the program of the evening which consisted of a film depicting the proper rendering of service. This film brought out the difficulties encountered by the customer and the dealer who had a "Jack of All Trades" as his serviceman who, when he had answered the service call of the customer, guessed he had fixed the unit. It likewise brought out the identity of interest and close cooperation ex-

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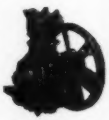

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isting between the distributor, dealer and Technical Division. When the customer's complaint reached the factory, immediately a factory trained serviceman was dispatched by the distributor to cooperate with the dealer in not only correcting the complaint, but in seeing that the dealer's serviceman was given the proper knowledge as to how to take care of that type of complaint. This factory trained man also pointed out to the dealer that rather than fire the man, he should take advantage of the manufacturer's offer, in that they would train the man to properly render that type of service which not only satisfied customers, but promoted sales.

DESIGN FACTORS

Following the showing of this film, Mr. Garthe spoke on a subject relative to thermodynamic design factors in refrigeration equipment. The factors covered in his talk follow:

THERMODYNAMIC DESIGN FACTORS IN REFRIGERATING EQUIPMENT

By PAUL GARTHE
Technical Division, Frigidaire Corp'n.

1. DEFINITIONS

(a) *Specific Heat*—The amount of heat expressed in B.t.u.'s to raise one pound of a given substance or degree Fahrenheit in temperature.

(b) *Charles Law*—With pressure constant the volume of a gas varies directly as the absolute temperature, or with volume constant the absolute pressure varies directly as the absolute temperature.

$$\frac{V1}{V2} = \frac{T1}{T2} \quad \text{or} \quad \frac{P1}{P2} = \frac{T1}{T2}$$

(c) *Absolute Zero*—A theoretical point 459.6°F below zero degrees Fahrenheit.

2. EXPLANATION OF THERMODYNAMIC PROPERTIES OF REFRIGERANTS.

(a) *Temperature.*

(b) *Pressure.*

(c) *Specific Volume*—Volume of substance per unit weight of one pound.

(d) *Density*—Mass divided by volume.

(e) *Heat Content.*

(1) *Ht. of Liquid*—Total heat of the liquid at the specified temperature equal to the specific heat of the liquid times the temperature difference from —40° to the specified temperature.

(2) *Latent Heat of Evaporation*—Amount of heat necessary to change state of the substance from liquid to vapor.

(3) *Total Heat of Vapor*—The sum of the heat of the liquid and the latent heat of evaporation at the specified temperature.

(f) *Entropy*—The total heat divided by the absolute temperature. Entropy is the distribution factor in a temperature entropy diagram. Entropy bears the same relation to temperature as volume bears to pressure. The entropy of a substance at a given state is the mathematical ratio obtained by dividing the amount of heat necessary to bring the substance to the given state by the absolute temperature during the heat transfer.

3. REFRIGERATING EFFECT

Refrigerating effect is the amount of heat which can be absorbed by one pound of refrigerant under given conditions of temperature and pressure.

Example:—"F-12" refrigerant

5° F. evaporator temperature. 86° F. Condenser temperature

From "F-12" tables—Latent heat of evaporation at 5° = 69.47 B.t.u./lb.

Ht. of Liquid at 86° = 27.72 B.t.u./lb.

Ht. of Liquid at 5° = 9.32 B.t.u./lb.

27.72 — 9.32 = 18.40 B.t.u./lb.

69.47 — 18.40 = 51.07 B.t.u./lb. net refrigerating effect—or

Total heat of vapor at 5° = 78.79 B.t.u./lb.
Heat of liquid at 86° = 27.72 B.t.u./lb.

Net R. E. = 51.07 B.t.u./lb.

therefore the quality of the mixture after passing through the expansion valve is

$$\frac{18.4}{69.47} = 26.5\%$$

R. E. for SO_2 under standard ton conditions 141.37 B.t.u./lb.

R. E. for methyl chloride under standard ton conditions 150.35 B.t.u./lb.

4. LBS. OF REFRIGERANT NECESSARY TO PRODUCE ONE TON OF REFRIGERATION UNDER STANDARD TON CONDITIONS

$$M = \frac{200 \text{ B.t.u./min.}}{\text{R.E.}}$$

"F-12"	3.915
SO_2	1.416
Methyl Chloride	1.331

5. THEORETICAL CYLINDER DISPLACEMENT

As the compressor pumps the refrigerant vapor, the specific volume of the vapor at the given suction pressure must be multiplied by the pounds of refrigerant circulated

per minute to determine the volumetric displacement of the compressor or T.D. $= \frac{200V}{Hl-hl}$

Where T.D. = theoretical displacement cu. ft. per ton of refrigeration.
V. = Specific volume of the refrigerant vapor in cu. ft. per lb. at suction pressure.
Hl = Total heat of vapor at evaporator conditions.
hl = Heat of liquid entering expansion valve.

Relative value of refrigerants—Standard ton conditions.

86° F. Liquid in condenser
5° F. Saturated vapor in evaporator

	"F-12"	*SO_2*	*Methyl Chloride*
Total heat of vapor B.t.u./lb. 5°	78.79	183.49	194.25
Total heat of liquid B.t.u./lb. 86°	27.72	42.12	43.9
R. E. B.t.u./lb.	51.07	141.37	150.35
Specific volume of vapor cu.ft./lb. 5°.	1.485	6.421	4.65
Lbs. of refrigerant per minute	3.92	1.41	1.33
Theoretical Displacement cu.ft./min.	5.82	9.09	6.06

6. Theoretical Compressor Capacities

Problem: A 2 cylinder compressor having a 2½" bore by 3½" stroke is operating at 500 r.p.m.

(a) Find capacity in B.t.u./hr. using "F-12" refrigerant operating at 125# head pressure and 35# suction pressure.

(b) Find capacity in B.t.u./hr. using "F-12" refrigerant operating at 125# head pressure and 11# suction pressure.

Solution:

Find cu. in. displacement per revolution $= \frac{N \text{ pi } d^2 L}{4}$

N = No. of cylinders
Pi = 3.1416
d = Bore in inches
L = Length of stroke in inches, therefore,

$$D = \frac{2 \times 3.1416 \times (2.5)^2 \times 3\frac{1}{2}}{4}$$

D = 34.4 cu. in. displacement per revolution

Compressor speed = 500 r.p.m. therefore cu. ft. displacement per hour $= \frac{34.4 \times 500 \times 60}{1728} = 597$ cu.ft./hr. displacement.

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(a) From the "F-12" tables at 35# suction pressure the specific volume of vapor equals .819 cu.ft./lb.

$$\frac{597}{.819} = 730 \text{ lbs. "F-12" per hour}$$

From the "F-12" tables:

Total H_r vapor per lb. at 35# = 82.49 B.t.u.

Total h_r liquid per lb. at 125# = 32.15 B.t.u.

82.49 — 32.15 = 50.34 B.t.u. net R. E.

Therefore, 730 × 50.34 = 36,800 B.t.u./hr.

(b) From "F-12" tables:

The specific volume at 11# = 1.514 cu. ft. per lb.

$$\frac{597}{1.514} = 394 \text{ lbs. "F-12" pumped per hr.}$$

From "F-12" tables total heat of vapor at 11# = 78.67 B.t.u./lb.

h_r liquid at 125# = 32.15 B.t.u./lb.

Net R. E. 46.52 B.t.u./lb.

394 × 46.52 = 18,350 B.t.u./hr.

7. Volumetric Efficiency

The volumetric efficiency of a refrigerating compressor is the ratio of the actual B.t.u. per hour capacity to the theoretical B.t.u. per hour capacity.

$$\frac{\text{Actual B.t.u. Capacity}}{\text{Theoretical B.t.u. Capacity}} \times 100 = \text{Per-cent Volumetric Efficiency.}$$

Factors affecting volumetric efficiency:

a. Superheating of incoming vapor in cylinder.

b. Wire drawing effect of gas through intake valves.

c. Leakage of gas past pistons and valves.

d. Re-expansion of gas in clearance spaces.

e. Compression ratio $= \frac{AHP}{ABP}$

Steps in Calculating Volumetric Efficiency:

Step No. 1. Find the theoretical displacement of compressor in cu. ft. per hour. Formula:

$$\frac{D^2 \times S \times .7854 \times R.P.M. \times 60 \times N}{1728} = \text{Displacement}$$

D = Dia. of cylinder
S = Stroke in inches
N = No. of cylinders

Step No. 2. Find number of pounds of refrigerant pumped or circulated within the

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system each hr. From the temperature of the superheated vapor entering the crankcase and the gauge pressure at the crankcase, refer to the tables of "Properties of Superheated Vapor" and under the column marked V, volume, find the volume in cu. ft./lb. If the exact value is not shown it will be necessary to interpolate to arrive at correct value.

Step No. 3. Find total heat of vapor leaving calorimeter. From the ave. (gauge) suct. pressure within the calor., and the actual temperature of the superheated vapor leaving the calor. and referring to the tables of "Properties of Superheated Vapor" find the B.t.u. content per pound under column H, or total heat of superheated vapor. If the exact value is not shown it will be necessary to interpolate to arrive at correct value.

Step No. 4. Find total heat of liquid entering calorimeter. From the temperature of the condensed refrigerant entering the calorimeter and referring to the tables of saturated vapor find the B.t.u./lb. under column "heat content of liquid B.t.u./lb."

Step No. 5. Find the refrigerating effect in calorimeter. Subtract the values obtained in Step No. 4 from the values obtained in Step No. 3. The result will be the net B.t.u./lb. or refrigerating effect within the calorimeter.

Step No. 6. Find theoretical B.t.u. capacity of unit. Multiply the value obtained in Step No. 5 by the pounds of refrigerant pumped per hour, Step No. 2. The remainder will be the theoretical B.t.u. capacity of the unit.

Step No. 7. Find volumetric efficiency of unit. Take the actual B.t.u. capacity of the unit obtained on calorimeter test and divide by the theoretical B.t.u. capacity and multiply by 100, equals percent volumetric efficiency of unit.

Example: Suppose a compressor has 2½" bore x 2⅝" stroke—525 r.p.m.—35# Suction Pressure at c.c.—Capacity 25,400 B.t.u./hr.
Find volumetric efficiency.

$$\frac{\text{pi } D^2 \times S \times \text{r.p.m.} \times 60 \times N}{4 \times 1728} = \text{Displacement cu. ft. per hour}$$

D = Diameter of cylinder in inches
S = Length of stroke in inches
N = Number of cylinders

$$\frac{3.1416 \times (2.5)^2 \times 2.625 \times 525 \times 60 \times 2}{4 \times 1728} =$$

469 cu. ft. per hour.

The suction vapor is entering the crankcase at 35# suction pressure superheated to 80°. From the "F-12" tables the specific

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The 1937

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volume of the vapor at 35#—80° is .904 cu. ft./lb.

$$\frac{469}{.904} = 518 \text{ lbs. per hour circulated}$$

Assume the pressure in the coil to be 37# superheated to 50°. From the "F-12" tables the total heat of the vapor at 37#—50° is 84.17 B.t.u./lb.

The normal condensing pressure under given conditions would be 120#/sq. in.

This corresponds to a liquid temperature of 102°.

The heat of the liquid at 102° = 31.65 B.t.u./lb.

84.17 — 31.65 = 52.52 B.t.u./lb. R. E.

518 × 52.52 = 27,200 B.t.u./hr. Theoretical capacity.

$$\frac{25400}{27200} = 93\% \text{ volumetric efficiency}$$

8. Effect of Heat Interchangers

The net refrigerating effect (B.t.u./lb.) can be increased in a refrigerating system, by taking advantage of the ability of a cold suction gas to absorb heat. By directing the liquid refrigerant to come into contact with the cold suction gas by means of a heat interchanger before it enters the evaporator, will cause the liquid to become sub-cooled and the suction gas superheated.

The theoretical amount of cooling through the superheating of the suction gas within the heat interchanger, is determined by the increase in the temperature of the gas as it leaves the interchanger, multiplied by the specific heat of the suction gas and the amount of gas pumped.

Sub-Cooling

The amount of sub-cooling actually taking place in the liquid refrigerant as it leaves the heat interchanger, is determined by the number of degrees which it is cooled multiplied by its specific heat and the pounds of refrigerant circulated.

The pounds of refrigerant circulated per hour at the temperature and pressure conditions in question can be determined by dividing the actual B.t.u. per hour capacity by the refrigerating effect (B.t.u./lb.) of the refrigerant in circulation. By the use of a heat interchanger, the net refrigerating effect (B.t.u./lb.) is increased approximately, in direct proportion to the amount in degrees the liquid refrigerant is sub-cooled. In running a calorimeter test, the suction gas is generally superheated within the calorimeter to a temperature equal to

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that of the test room. Through this procedure the maximum refrigeration effect is obtained within the calorimeter and the use of an interchanger would be of no advantage.

In an ordinary refrigerating installation (for example a walk-in cooler) the suction gas can only be superheated to a temperature approximately to that temperature within the refrigerator, which is usually around 40° F. In an installation of this kind a heat interchanger will increase the net refrigeration (BTU/lb.) by taking advantage of this cold suction gas to remove some of the heat from the liquid refrigerant before it enters the evaporator.

Example: Suction vapor enters heat interchanger at a pressure of 17# superheated to 30°. Vapor leaves interchanger at 18# superheated to 80°. Liquid enters interchanger at a temperature of 100°. Find temperature of liquid as it leaves interchanger and gain in Refrigerating Effect.

Hl at 17# 30° = 82.08 B.T.U./lb.
hl at 102° = 31.65 B.T.U./lb.
R. E. without interchanger = 50.43 B.T.U./lb.
Hl at 16# 80° = 89.40 B.T.U./lb.
Hl at 17# 30° = 82.08 B.T.U./lb.

Gain by using interchanger = 7.32 B.T.U./lb.
hl at 102° = 31.65 B.T.U./lb.
7.32 B.T.U./lb.

hl leaving interchanger 24.33

Temperature of liquid leaving interchanger corresponding to heat of liquid of 24.33 B.T.U./lb. is 72° F.

R. E. by using interchanger = 89.40 — 31.65 = 57.75 B.T.U./lb.

$\frac{57.75 \times 100}{50.43} = 11.4\%$ Gain in R. E. by using interchanger.

The descriptive talk was followed by another film which showed the operation of the thermostatic expansion valve and the proper method of adjusting this type of throttle valve in conjunction with the pressurestat for obtaining the temperature in the equipment desired by the customer. At the culmination of this film, Mr. Garthe announced that this finished this part of the program, with the exception that if any of those present should desire to ask questions, he would be pleased to answer such ques-

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tions. After answering a number of questions asked by members, Mr. Garthe then turned the meeting over to Mr. de LaGrange. Mr. de LaGrange then, in the following order, introduced:

Mr. C. N. Linville, Installation & Service Manager of the Johnson-Wahle Company, Buffalo. Mr. Linville spoke briefly on the cooperation of his firm in the rendering of any assistance to the serviceman.

Mr. George Eggert, who is in charge of the Frigidaire Parts Division of General Motors, Buffalo, who likewise voiced Mr. Linville's sentiments.

Mr. Stafford of the Commercial Sales Division of General Motors Sales Corporation, briefly outlined a plan wherein his Department would help to promote sales made by the serviceman himself, in that the plan offered assistance of the G.M.A.C. finance plan to the potential prospects. Rather than take up too much time at the meeting, he proposed that any man wishing to take advantage of his Department's assistance, should call upon him personally at his office.

Mr. de LaGrange then turned the meeting over to President Donald Schuster. Mr. Schuster proposed a rising vote of thanks to Mr. de LaGrange and his associates who had assisted him. After this was accorded them, Mr. Schuster introduced Mr. George O'Hara, Chairman of the Entertainment Committee, who briefly outlined the social activities of the next few months, which included a card party and the annual banquet. The meeting was then turned over to Mr. George Wilson.

Mr. Wilson explained the purpose of the different colored tags that had been given to each member and guest as they entered the meeting, with the request that they sign their name to both sides of it. The different colors of the tags, the color scheme of which he outlined, designated the member of the General Motors Corporation, the member of the Society and a guest. He asked each and everyone present to make themselves acquainted by means of these tags. He likewise stated he wished to take this opportunity to publicly thank the Vice-President of the Independent Refrigeration Company, Mr. Fred Cameron, for the assistance he had rendered the Educational Department in arranging with Mr. de LaGrange for the program of the evening which proved so interesting.

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Announcement was then made that through the courtesy of Mr. de LaGrange of the Frigidaire Division of the General Motors Corporation, a buffet luncheon would be served in the adjoining room.

\$ \$ \$

ST. LOUIS CHAPTER

Meeting of February 11, 1937

By **E. A. PLESSKOTT,** *Secretary*
2145 67th St., St. Louis, Mo.

THE regular meeting of St. Louis Chapter held on February 11th was called to order by President Gygax at 8:30 P. M. The minutes of the January 14th and 28th meetings were read and approved.

Accumulated correspondence from National headquarters, President Paul Jacobsen, the GMC and Business News Pub. Company was read and discussed.

The Secretary outlined the procedure and cost for reinstating suspended members, and promised to have at the next meeting complete data ready to give out in cases where members wish to help by making personal contact.

The proposed meeting with the A.S.R.E. to be held in the near future for the purpose of getting a code started for this city was fully discussed by Messrs. Gygax and Tinkey, and both stressed the need for a good turn-out at these meetings.

The Secretary announced the dates and page numbers in our Official Organ under which will be found information pertaining to codes in various cities and suggested that members read these articles, jot down any more points and bring them up at future meetings. If we are unable to clarify the situation in open discussion we shall contact the city whose code is in question, and get a report amplifying any clause or clauses in question.

Mr. Tinkey spoke briefly on the contacts he has made for future meetings, which show promise of being most interesting if the plans already started carry through.

Mr. Gygax announced that the special representative or contact man which National President Jacobsen requested be appointed, would be made by mail and Mr. Jacobsen notified. Other appointments to various committees will be made in the near future.

Before accepting a motion for adjournment the secretary requested the permission of the floor for several minutes. This being granted he explained that on February 12th each year he reads the "Emancipator's" re-

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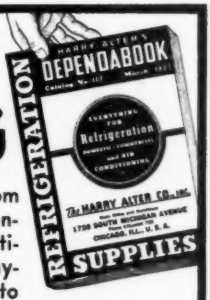

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nowned Gettysburg address, and this being the following day he requested permission of those present to read it. No objection, he proceeded to read it.

S S S

MEMPHIS CHAPTER

Meeting of February 10, 1937

By **W. C. EASLEY,** *Secretary*
2590 Yale, Memphis, Tenn.

THE regular meeting of the Memphis Chapter was held at the chapter hall at 943 Madison Avenue and was called to order at 8 P. M. by 1st Vice-President Bland L. Bridges.

After the roll call of officers the meeting was turned over to the Educational Committee. The Chairman, Ed Geiser, gave a talk on the electrical control circuits of the General Electric hermetic units.

To create further interest in the educational work Mr. Geiser asked that the different members give talks and debates on the subjects pertaining to the refrigerating industry with which they are most familiar.

Mr. W. Hall Moss was selected to be the first member to make a talk at the next meeting February 17th. His subject is to be the ice cream cabinet.

The following week on February 24th is to be a debate between Boyd Evans and Bill Easley on Expansion Valve vs. Low Pressure Float Valve.

Due to the good time enjoyed by all present at the box party at the last meeting a motion was made by Mr. John Riehlmann, seconded by Boyd Evans, that the first meeting night of each month be given to the Ladies' Auxiliary for the entertainment of the chapter and the auxiliary. This motion carried.

Correspondence from the National office pertaining to the membership dues was read and discussed and the Secretary was instructed to notify all members that their dues must be paid before March 1st.

S S S

AKRON CHAPTER HAS LADIES' NIGHT

AN annual event of Akron Chapter is the banquet held at Young's, which is quite a famous spot in Ohio for the excellency of its food.

This year Akron Chapter decided to have the ladies participate in the banquet, and

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accordingly sent invitations to two neighboring chapters—Youngstown and Cleveland—for the evening of February 17. Cleveland Chapter chartered a bus and some thirty members and their wives attended the excellent dinner.

After the banquet the members and their ladies enjoyed several reels of motion pictures. Mr. Claude Wall, past-president of Akron Chapter, served as chairman of the meeting, and plans were completed for the formation of the Ohio State Association, which will be the first state organization of the National Society.

The Ladies Auxiliary was also discussed, and the ladies were encouraged to meet as a group at an early date and plan for the formation of Ladies Auxiliaries in the chapters.

YOUNGSTOWN CHAPTER

Meeting of February 15, 1937

By M. W. BOKESCH, JR., *Secretary*
R. F. D. No. 5, Youngstown, Ohio

PRESIDENT M. Bokesch, Sr., called the meeting to order, followed by roll call of members. Minutes of the last meeting, and the Treasurer's report were accepted as read.

Chairman E. Wright of the Licensing Committee reported on the progress of the committee. The committee met with Mr. Boucherle of the City Engineering Department, and he is going to rewrite the petition to conform with the proposed changes.

A letter from Akron (Ohio) Chapter was read, inviting the members to a dinner party to be held on the 17th of February. Members indicating their desire to attend were Messrs. Ed. Wright and M. Bokesch, Sr.

Motion was made and carried to collect $7.50 as the initiation fee and $5.00 per annum for dues.

PITTSBURGH CHAPTER

Meeting of February 8, 1937

By F. V. GOLITZ, *Secretary*
1518 Davis Ave., Pittsburgh, Pa.

THE regular meeting of Pittsburgh Chapter was held on February 8th in the Commonwealth Building. Mr. John Kirch, president, presided.

Mr. C. O. McCauley spoke about the advisability of a campaign to bring the 1938 Convention to Pittsburgh. After a lengthy discussion of this subject it was tabled until the next meeting.

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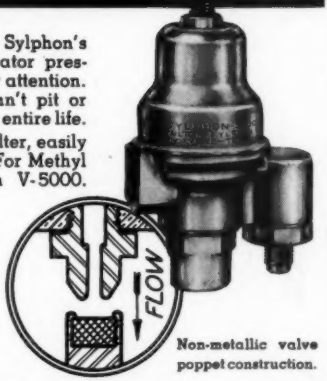

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The Secretary read the minutes of the January meeting and same were approved as read. The correspondence was read and commented on by the members. The Secretary reported on the plans for cooperative advertising in the telephone book and in the newspapers.

President Kirch appointed the Chairman of the following Committees: *Membership and Investigating*—H. A. Daum; *Educational*—N. D. Wagener; *Standards and Cost Records*—R. B. West; *Visiting*—G. W. Gunnell; *Entertainment*—A. H. Ross; *Finance*—F. V. Golitz.

A discussion of the methods of investigating and approving applications for membership was referred to the Membership Committee.

Moved by J. Barbagallo and seconded by A. H. Ross that the membership of F. L. Murray be transferred to L. R. Laterer and that of Ben Stern to C. W. Thorn due to the transfer of the former in each case to a department other than refrigeration.. Motion carried.

Moved by G. Gunnell and seconded by J. Barbagallo that the Entertainment Committee arrange for a study of "The Proper Temperature for Storing and Serving Beverages" at one of the breweries. Motion carried.

Four applications for membership were referred to the Membership Committee.

KANSAS CITY CHAPTER

Meeting of January 27, 1937

By R. E. KINGSOLVER, *Secretary*
3830 Woodland, Kansas City, Mo.

THE meeting was called to order by President H. L. Green, followed by roll call of officers and members.

Letter from National Secretary McDermott of January 8th was read and for-

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warded to the Finance Committee. Letter to be read at next regular meeting. The finance committee was instructed to present their findings in a form of a motion.

President Green, with the assistance of Messrs. Joe Leitner and Steve Leitner, wrote letters to various manufacturers. Mr. Green has received some ten letters from manufacturers asking to be represented at early meetings.

Audit was made of the Treasurer's books by Mr. Joe Leitner.

Mr. Cal Kester and Mr. Otis Clark were elected to serve as directors for the year of 1937.

A motion was made and seconded, inasmuch as associate members are now serving on committees, that the said associate members will remain in their same standing in the society.

* * *

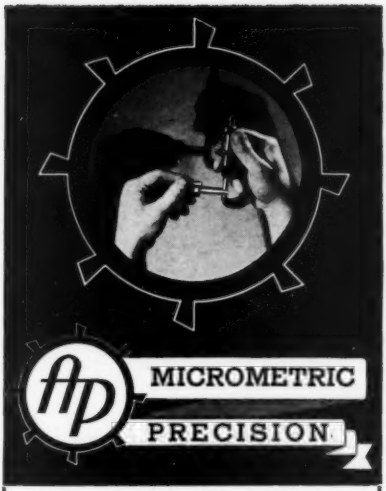
CHICAGO CHAPTER

Meeting of February 9, 1937

By **WILLIS STAFFORD,** *Secretary*
726 Hinman St., Aurora, Ill.

A LETTER from Harry Logemann was read, asking that a committee be appointed to call on Mr. E. P. Sorensen of the Utilities Engineering Institute to ascertain if a course on servicing air conditioning equipment could be made available to the members. This course would go into only such problems as the service man might encounter in making adjustments to this equipment. This letter was referred to the Board of Directors with the recommendation that they take immediate action on this matter. A paper was circulated, upon which twenty-four members signed their names, indicating that they would be interested in a course of this nature.

President I. Skipple reported that he had



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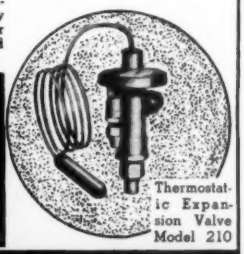

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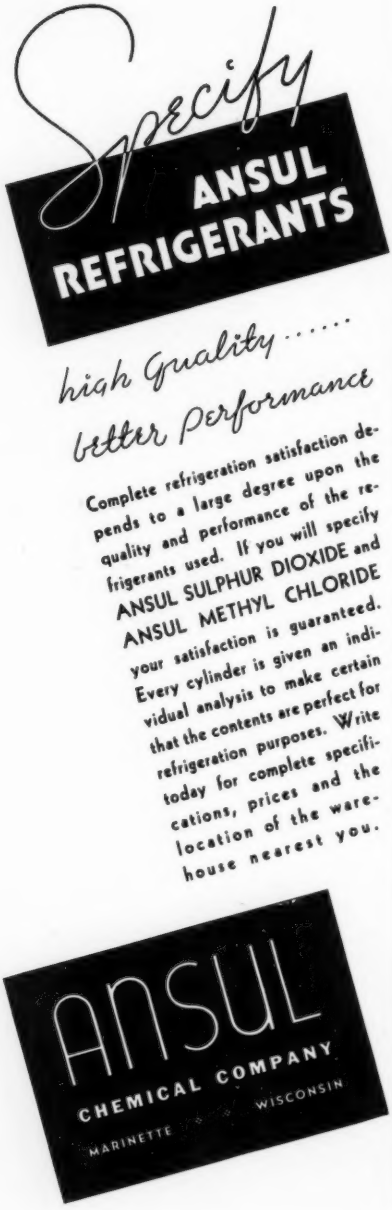
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been called into a meeting with the Chicago City Council and representatives of all interested groups, to discuss proposed changes in the City Refrigeration Code. The most important of these changes is a license fee and examination. In view of the fact that President Skipple is not connected with any other organization similar to ours, a motion was made by Mr. Stafford, seconded by Mr. Schroeder, and duly carried that President Skipple act as chairman of a committee to meet with the City Council and approve or disapprove, as they may see fit, any clauses in the new ordinance, which may implicate members of the R.S.E.S. President Skipple appointed Mr. A. Schroeder, W. V. Lowitz and M. Axelrod to act with him on this committee.

Mr. Drownes pointed out that the membership of the Chicago Masters Association are 100 per cent members in the R.S.E.S. and therefore members of their ordinance committee will likewise be members of the R.S.E.S.

Secretary Stafford presented a leather bound copy of Robert's Rules of Order to President Skipple for his use in deciding parliamentary procedure. This book has his name inscribed in gold on the cover and it is to be retained by him upon retirement from office.

Fred Roth, chairman of the Membership Committee, appointed the following members to his committee: H. W. Blythe, G. Monjian, A. E. Karlberg, R. B. Vanston, J. Holub, Jr., S. J. Majeski, H. R. Spivak, A. Schroeder, M. T. Halter, W. L. Friday, H. Drownes, J. Corso, O. Armstrong, Herman Goldberg and W. Mills. It was decided that in the membership campaign we would follow the procedure of past years in awarding members for securing new members. Namely, anyone getting five members will be allowed a credit of $5.00 on

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his dues and he will have to pay, then, only $2.50 balance for the year's dues.

At this time the committees of our organization, and the Chicago Masters Association retired for a joint meeting on the discussion of the proposed new City Refrigeration Code.

The meeting was then turned over to 2nd Vice-President P. Bossert. For the educational program a round-table discussion was held on the subject of stuck-up SO_2 compressors. Some very interesting high-lights and new methods were brought out in this discussion.

President Skipple made the following appointments: Mr. George Monjian, chairman of the Chapter Entertainment Committee, and Mr. Harry Logemann as chairman of the Examining Board.

Meeting of February 23, 1937

This meeting was called to order at 8:00 P.M., with all of the officers being present. Minutes of the last meeting were read and approved.

Mr. Harry Logemann, chairman of the Examining Board, selected Messrs. Long, Bossert and Vanston to act with him on this Board.

Mr. Holmes of the Utilities Engineering Institute gave a very interesting talk on air conditioning. He took a typical restaurant and illustrated how to figure the load of the room.

After a lengthy discussion, a motion by Mr. C. Cappels was carried, that we have some special entertainment at our second meeting in March. The Entertainment Committee is to have full charge and responsibility for this meeting.

Mr. Roth, chairman of the Membership Committee, posted the names of eight new members. These men will be initiated at the next meeting with a special program.

Copeland is Going Places

● You will see this colorful Copeland "salesman" in hundreds of show windows throughout the United States during the coming months. You will see Copeland advertising in your local newspaper—in the SATURDAY EVENING POST—in TIME—in the trade magazines—in business publications.

All this is part of the aggressive sales campaign which is being conducted for the purpose of creating hundreds of new Copeland owners in every locality.

Copeland renders quick service in both the domestic and commercial fields by maintaining complete stocks of parts for all models.

COPELAND
REFRIGERATION CORPORATION
DETROIT, MICH.

DENNIS GASKETS
FOR ALL MAKES REFRIGERATOR DOORS

A complete line of rubber - coated, packed gaskets and extruded rubber gaskets that last longer—retain higher efficiency—because made of finest materials and workmanship. Write for samples, giving your jobber's name

W. J. DENNIS & CO.
2110-20 WEST LAKE ST. CHICAGO

Mr. Goldberg, chairman of the General Convention Committee, reported briefly on the present set-up for the convention.

TWIN CITIES CHAPTER

Meeting of February 9, 1937

By J. SAMWAYS, *Secretary*
3015 Clinton Ave., S., Minneapolis, Minn.

MINUTES of the preceding meeting were read and accepted, after which President A. E. Johansen introduced the visitors who were at the meeting.

The Treasurer's report was given and accepted. Authorization was given for the Treasurer to have some statements printed; also, for the payment of an invoice for flowers for the funeral of a member's relative. Motion was made, seconded and passed that the Executive Committee have the power, in the future, to order flowers for any occasion they see fit.

Mr. Spotsworth, our tentative speaker for the evening, was unable to be with us. Mr. Spotsworth is Chief of the Fire Prevention Bureau of the city of Minneapolis. We expect him to be with us at our next meeting. Mr. C. A. McCafferty gave us some points for discussion which he believed Mr. Spotsworth would have brought up.

President Johansen then read letters from the Ansul Chemical Co. and the Dayton Rubber Co. These companies stated they would be more than willing to furnish speakers at some future meetings.

Mr. A. M. Palen then took the floor and explained the operation of a Majestic hermetically sealed unit, showing us the various parts of the compressor and their functions.

Mr. Sharbach of the Snap-On Tools Company gave us a talk on tools. He stated that the Snap-On Tool Company is ready to make any tool that the refrigeration service man needs if we will tell them what these tools are.

Mr. Swedberg was absent, so Mr. Johansen gave us a lecture on our Lecture No. 4.

"THE CONTRIBS' COLYUM"

By THE KINGFISH

With the damage from disastrous floods this year no doubt the boys in Cincinnati, Pittsburgh, and Memphis and other points have been busy in getting refrigeration equipment in operating order.

We hear rumors that a Fairbanks Morse Chapter may be formed. Some hundred men from all over the country were together in Indianapolis last month and Bill Drake called a special meeting of his chapter and invited them all to attend. Dan Wile gave one of his delightful talks on expansion valves. Paul Jacobsen told them about the Society and the many advantages of belonging to the R.S.E.S.

Congratulations, Ivar Skipple. We hear that you are heading the convention city chapter this year.

The name of the R.S.E.S. is now registered in the Dominion of Canada also. Our good friend A. E. Doan saw to it that no other organization could take that name.

According to Herman Goldberg in "Views and Reviews" it looks like we cannot help but make money in 1937.

We notice that Willis Stafford is impressed with the neat installation work in Norway as shown by the picture on the cover of the September issue. Well we can show him many installations just as neat and made

RAPID HEAT TRANSFER!

Patented "THERMO FIN" in tube speeds up flow of refrigerant INCREASING EFFECTIVE SURFACE.

WRITE FOR OUR 1937 CATALOG

"THERMO FIN" TUBES
available in all coils made by

MANUFACTURERS FIN COIL COMPANY
2505 South Pulaski St. CHICAGO, ILL.

Automatic refrigeration relieves a woman of a thousand cares, worries, annoyances—and needless jobs that wore her mother into wrinkled age.

EXTRA DRY ESOTOO and V-METH-L relieve the manufacturers and the service engineer of all worry as to the quality of the refrigerant necessary for satisfactory operation of their refrigeration units. They know EXTRA DRY ESOTOO and V-METH-L are pure, dry, and available for immediate delivery.

VIRGINIA SMELTING CO.
WEST NORFOLK VIRGINIA

by local boys. The days of hanging the tubing like spaghetti ended when the R.S. E.S. started.

And by the way, what's this we hear, Willis? A newcomer made his appearance at the Stafford residence. Yes sir, a seven pound future service engineer. Congrats, Mr. and Mrs. Stafford.

Reading that Mr. Gygax from St. Louis came back from a trip to Europe, we want to know whether he made a general trip of the continent or just visited some particular country. Personally we have paraded on busy Schiedamske Dejk in Rotterdam, driven a horse and buggy along Parade Platz in Stettin, ridden on top of a bus through Ostergade in Copenhagen, sat on a sleigh while gliding along impressive Carl Johan in Oslo, Norway, sailed up to Edinburgh, in Scotland, haunted the docks in Oran, Morocco, sailed in a boat at Godthaab, Greenland, so let us hear something about what you saw, Gygax.

VIEWS AND REVIEWS

By HERMAN GOLDBERG

I HAVE received a number of letters recently through which a common fear is expressed, caused by the entry of powerful competition in the writers' fields and locations.

New competition of this kind should be expected, I believe, rather than feared. It stands to reason with the newer developments, especially in our industry, that new money will be invested and naturally the people who invest this money are going to try to see that it will bring them profitable returns for the ideas and developments which they, in turn, contribute to the industry.

Most of the fear of these so-called newcomers seems to be expressed by people who have been established for the past five or six years and have done very well due to their own aggressive policies and good business methods, which, of course, helped them to outsrip their own competitors. Companies of this type, I believe, have very little to fear from big competition because they have proven through the past years that they are very capable of taking care of themselves and should by all rules of the game, be able to maintain their volume of business against their new competitors who will be represented in the field by department, divisional or branch salesmanagers.

I think that the advantage lies with the already established company because the owner usually can move and adjust himself a great deal faster than the man representing the larger company who must frequently be bound by certain policies, and through necessity must go through a lot of red tape in order to change to meet competition.

The men usually put out by a large company to take care of different divisions or departments are of very good calibre, and if given the opportunity by other competition, usually are the cleanest and best of competition, and also, if given the opportunity will cooperate in fair trade practices.

All in all, we should welcome this competition.

P. S. Scandal

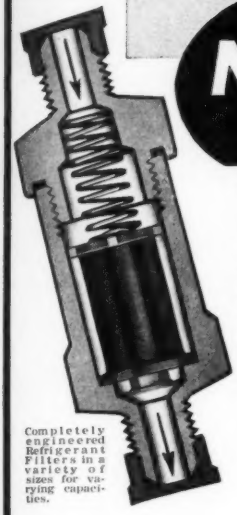
While in Detroit last week I learned that Mrs. Joe Oberc recently purchased her husband a swell set of long, form fitting, sky blue underwear, which moved a certain young lady to send Joe a poem mostly about the color. In order to avoid a repetition, I believe the Mrs. is going to hereafter stock Joe up on old fashioned red flannels, about which no poet or poetess could possibly write a sonnet.

Write for bulletins on the complete line of Blue Ribbon Appliances.

American Injector Co.
1481 14th St. Detroit, Mich.

NEW VALVES . . Small in Size
Big in Performance *Type "F"*
AUTOMATIC EXPANSION VALVES

These valves are especially designed for the smaller units. Bodies are hot pressed die forgings, close grained and non-porous. The springs are extra length for smooth, velvety adjustments. Needles are special alloy, adaptable for any refrigerants. The breather cap is of live rubber with threaded metal insert. And these are just a few of the many outstanding construction features of these superior valves. No. 1582, ¼" S.A.E. inlet—¼" F.P.T. outlet. No. 1583, ¼" S.A.E. inlet — 1¾" bolt centers. Type "F" valves are interchangeable with all refrigerants except ammonia.



Completely engineered Refrigerant Filters in a variety of sizes for varying capacities.

NEW ZENITH REFRIGERANT FILTER

Saves You Time and Money . . . Cuts Down Useless Calls . . . Increases Number of Satisfied Customers

Zenith Filters have already proved their value and efficiency in thousands of commercial installations. Now these new specially built Filters are available for any size or type refrigerator using Sulphur Dioxide, Freon or Methyl Chloride. Better performance, greater economy, minimum service and better satisfied customers will result from their use in new or old models.

These features put the Zenith Filter in a class by itself—Patented Element—Easily and Quickly Cleaned—Easy to Install—Insures positive protection from dirt in the refrigerant liquid—Corrosion-proof, leak-proof and ample capacity.

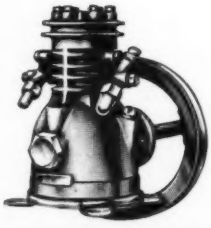
Write for full details

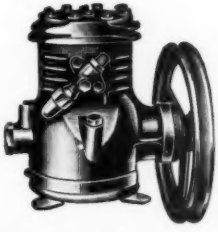
ZENITH CARBURETOR CO.

Subsidiary Bendix Aviation Corp.

DETROIT, MICHIGAN

"Chieftain" Quality Built Compressors and Condensing Units





See Your Jobber

For Literature and Prices on Our Complete Line

Save money by installing "Chieftain" Compressors instead of trying to satisfy exacting customers with rebuilt compressors or condensing units.

"Chieftain" Compressors are made to last. Precision limits are maintained on all parts. Our new and exclusive lubrication system insures longer life and higher efficiency, as well as a quiet operating unit.

In addition to quality we offer prices that will permit you to make a higher percentage of profit as well as a saving of time, which will enable you to satisfactorily handle a larger volume of business.

TECUMSEH PRODUCTS COMPANY, Tecumseh, Michigan

Refrigeration Division

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TIME and Tide have nothing on REFRIGERANT FUMES!

They "wait for no man"

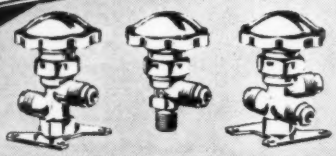
HEALTHGUARD FUME KIT

Nullifies fumes as a menace to servicemen's safety. Designed especially for refrigeration work, with cartridges for methyl chloride, ammonia and sulphur dioxide. Compact—light—efficient—low cost. *Most essential "tool" you can get.* Write for bulletin.

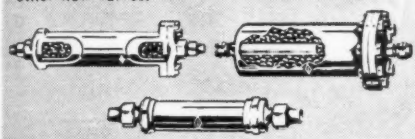
CHICAGO EYE SHIELD CO.
2341 Warren Boulevard
CHICAGO, ILL.

Announcing—

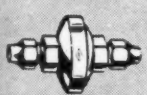
—extensive additions to the Imperial line



NEW VALVES—New "Sylpak" valves with shorter bonnet to fit 4" conduit box—also many other new valves.

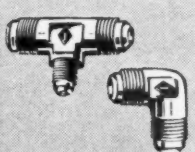


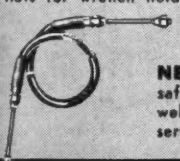
NEW DEHYDRATORS—Cartridge refill type, dispersion tube type, a small low priced dehydrator, and a line of large steel shell dehydrators 4 inches in diameter.



NEW STRAINERS—Sealed strainer with mesh screen and asbestos sack, a small size strainer, and a forged brass line strainer.

NEW FITTINGS—Large number of new sizes and all tees and elbows will have flats for wrench hold.





NEW TOOLS—New safety charging line as well as a wide variety of service aids.

SERVICE men, jobbers, and manufacturers who have seen the new items in the Imperial line have shown a lot of enthusiasm. On every hand word has gone out that the Imperial line is "tops" in completeness and quality.

You will want the new Imperial catalog No. 77-F that covers all of these new items and other products for air conditioning and refrigeration work. This catalog will be a great help to you in your service work.

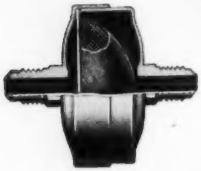
Be sure to specify IMPERIAL when you order valves, fittings, tools, charging lines, floats, strainers, dehydrators, and other items from your jobber. You will find these new items in jobbers stocks, but if you have the slightest difficulty in getting Imperial items in your locality, just mention that fact when you write for your new catalog.

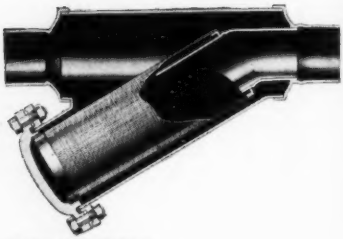
IMPERIAL BRASS MFG. CO.

1204 W. Harrison St., Chicago

ORDER FROM YOUR JOBBER

IMPERIAL *Refrigeration and Air Conditioning Products*





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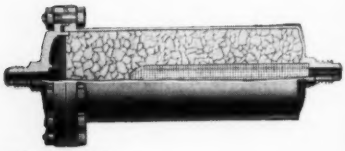
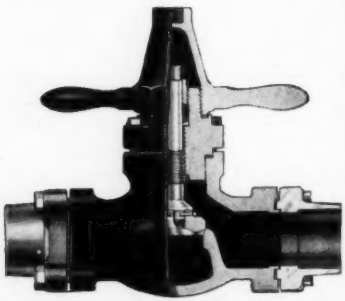


DRYERS



VALVES Freon and Methyl Chloride

• SERVICE TOOLS

HENRY VALVE CO.

THE *Jobber* WHO SELLS HENRY PRODUCTS IS ALERT TO THE NEEDS OF THE INDUSTRY.

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Our new Catalog 62 describes the complete line. It's yours for the asking.

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HENRY VALVE COMPANY

1001-19 N. SPAULDING AVE. CHICAGO • ILLINOIS

Here are a few of many reasons ***why***

PERFECTION WATER REGULATORS

—are certified to excel.....

VALVE BODY and YOKE *are integral.* Machine tolerances are held to a minimum to insure maximum Push Stem length—thus giving extreme capacity and sensitivity.

Can be mounted in a rigid position—and Valve Cap and Seat Assembly *can be removed* without breaking or straining water pipe or refrigerant connections.

All parts of the valve are *readily accessible* for inspection and replacement.

VALVE CAP and PISTON are *made of special valve bronze and are not affected by corrosive water action.* Sticking or binding of the piston in the cap is completely eliminated.

The Perfection Water Regulator is an absolutely tight-closing, wide opening, noiseless valve.

Each valve is application-tested with 200 pounds of pulsating water pressure.

SEAT BEAD *is replaceable.* This Seat is threaded into the Valve Body and holds pressure tight by a taper which back seats at the hole of the bead.

A standard hexagon broached hole in the center of the Bead fits any wrench set or Allen Set Screw Wrench.

The Bead and Valve Disc are the only wearing parts of the Perfection Valve, and are *completely replaceable without removal* of the Valve from the line. This means these parts can be *changed on the job* at a total cost of about 25c for the parts and 15 minutes time.

THESE ARE BUT A FEW OF MANY SUPERIOR FEATURES of Perfection Water Regulators. Be sure to ask for *complete* information on these valves as well as on the entire line of Perfection Certified Parts including Compressor Parts, Valves, Fittings and Tools.

PERFECTION REFRIGERATION PARTS CO.

(A division of Perfection Gear Company Established 1919)

THE MARK OF PERFECTION CERTIFIED PARTS

HARVEY, ILLINOIS

Added Features Improved Performance and

NEW LOW PRICES

INCREASED ratings. Closer differentials. New finish. New durability. Sealed construction. These are but a few of the new advantages now available in Minneapolis-Honeywell Refrigeration Controls, and they come to you at NEW LOW PRICES. Complete information on these startlingly new developments will be available shortly. Write for it and remember, all these improvements, plus the same features that have made Minneapolis-Honeywell Refrigeration Controls outstanding, are now available at new low prices. Minneapolis-Honeywell Regulator Co., 2934 Fourth Ave. So., Minneapolis, Minn. Branch and distributing offices everywhere.

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Dependable Controls Cost Less Than Service

AUTOMATIC CONTROLS MH

MINNEAPOLIS-HONEYWELL

Control Systems

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